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Cost of Unmerging

SIGNIFICANT it is when a man with so much experience in railroad affairs from the public point of view as John M. Eshleman, Lieutenant Governor of California and former chairman of the California State Railroad Commission, sides with the railroad in a Government merger suit. This is what he has done, however, in the proceedings against the Southern Pacific Company. In his opinion the divorcement of the two main systems controlled by this company would unfavorably affect both service and rates—and service and rates, together with safety, which is a part of service, and the issuance of securities, which could in any event be controlled by proper legislation, encompass practically everything in which the public at large is interested. Before seeking new victims of the Sherman law, the zealous Government officials would do well to ascertain whether the offending railroads or the people they serve will have to pay the costs.

Traffic and Pedestrians

PRESENT efforts to relieve traffic congestion in large cities have not as yet developed a panacea, but from the various experiments in progress it is reasonable to look for improvement. There are two objects to be sought—the protection of the pedestrians and the facilitating of vehicular movement. For the first purpose "safety zones," shown by painted lines on the pavement, and isles of safety are in use. Drivers of automobiles, however, have not yet been educated to the point of respecting the neutrality of the zones. Only rigid enforcement of the law, by arrest and punishment, will accomplish the desired results. The raised isles of safety, on the other hand, force respect because of the danger of damage to the trespassing vehicle and the flagrant and evident character of any violation. They have the disadvantage, on the other hand, of restricting the trafficway, a sufficient reason for ruling them out on narrow streets. In controlling the movement of vehicles, Philadelphia's semaphore system is valuable, while the "multiple-unit" control method tried on Fifth Avenue, New York, in which one traffic officer signals to his comrade for some distance down the street in order to secure simultaneous movement of vehicles over several blocks, holds possibilities despite the very evident difficulties. In some cities the regulations prohibit vehicles crossing the street except at intersections, while a great number of rather elementary rules of great advantage have become standard in police regulations of practically all of our towns of 100,000 population and over. In general, the regulation of a moderate traffic is a very simple matter. Only when the congestion becomes acute is difficulty experienced, and consequently careful investigation needed. Obvious rules take care of moderate traffic; more complicated ones are needed where it is dense. Much thought has already been given the subject, but since in the largest cities of the country it grows more serious every year, it warrants all the attention it is receiving. Without a doubt in most large communities underground railway systems will become necessary to prevent the congestion becoming intolerable, but a large measure of inconvenience must always be one of the penalties of congested business centers. About all that can be hoped for is to keep conditions tolerable during the rush hours—the critical period for any traffic-regulation scheme.

2,000,000-Bale Cotton Terminal

COTTON-HANDLING devices that accomplish what cotton men have hitherto considered impossible of accomplishment, the removal of a bale from the bottom of a pile without disarranging the pile, and make practicable the construction of one-story warehouses at a great saving in cost of construction, per bale capacity, over the multiple-storied type, will be part of the equipment of the new 2,000,000-bale cotton warehouses and terminal plant being constructed in New Orleans. These devices are capable of removing bales at any point from tiers ten and fifteen bales high. It is this feature that does away with the necessity for the multiple-storied warehouse, the whole object of which, as related to cotton storage, is to provide floor space sufficient to permit the piling of cotton in tiers of lesser height. Other features of the design of this plant, which is described on page 402, are the adaptation to the handling of cotton of the continuous conveyors commonly used for handling other commodities and the layout of the railway tracks so that, in emergencies, the locomotives and cars of the surface system can be used to help out the overhead equipment in carrying the cotton from the warehouses to the ship and vice versa. The plant marks a step forward in solving terminal problems, in which progress has been slower here than abroad.

Full Crew Law in New Jersey

PUBLICITY has brought the beginning of victory to the railroads of New Jersey in the matter of the obnoxious "extra-crew" law of that State. For some time past a joint legislative committee has been hearing arguments on both sides. The railroads have not, as they might have been justified in doing, merely contended for the outright repeal of the law. They have, on the contrary, urged its replacement by an act giving the Board of Public Utility Commissioners authority to decide in the case of each train how many men shall constitute a full crew. The railroads have insisted that no general rule can be laid down as to what safety requires, and their arguments have been simple and unanswerable. The railroads' bill has, therefore, been accepted by the proponents of the original extra-crew law, passed two years ago, and it is reasonable to believe that it will become law. It is to be hoped that it will, and that the railroads' policy of recognizing whatever of good there was in their opponent's arguments will be equally successful in Pennsylvania.

Constitution Making

IT is apparent that the engineers of New York State do not propose to leave the coming constitutional convention pass without seeing, so far as they are able, that their aid is vouchsafed the delegates on those matters on which the training of engineers qualifies them to speak. The National societies have committees discussing the points that may be brought up, and the committees will act jointly in what they may present to the delegates individually and to the convention. Last week, as reported, in this journal of March 20, page 382, members of the civil engineers' society met to discuss the suggestions of its committee. The proposals were in the direction of more effective executive control and were thus in harmony with the movement in recent years toward centralized responsibility. It was, therefore, recommended that the office of State engineer and surveyor be abolished, the duties being assigned to the department of public works under an appointive officer, responsible to the Governor. Under this department, too, would come all other engineering activities of the State, a departure much to be desired. It was further recommended that engineers be placed in charge of the bureaus of this department and that one of the commissioners of public utilities be an engineer. Some question may be raised as to the need of a consulting engineer attached to the staff of the Governor, except if it be unlikely that the convention would accept the proposal to make it incumbent on the Governor to appoint an engineer to head the department of public works. If the head of that department were an engineer it would seem that he might perform the duty of advising the executive on engineering matters. If the desirable fundamental character of a constitution be borne in mind, it is evident that many of the matters recommended have no place in it. This, though not mentioned at the meeting, is the feeling of the committee. It was thought well, however, to be prepared for an emergency, if the convention should insist upon departing from the code of principles, which is all a constitution should be. If the convention does not take up these matters, the work will not be lost, for the suggestions can then be embodied in bills to be presented to the Legislature.

Keen Interest in Activated Sludge Investigations

ACTIVATED sludge experiments are multiplying in the Middle West at such a rapid rate that very shortly engineers ought to have in hand the answer to many questions concerning this development. The very few days required to get sludge activated to a high point of efficiency makes laboratory experiments particularly fascinating and should result in settling most of the problems, at least as to feasibility and obtainable results, before large units are undertaken. There will then still be the details which need adjustment when laboratory experiments are expanded to operating proportions.

Last week the Lake Michigan Water Commission viewed the laboratory tests which the Milwaukee Sewerage Commission has under way. A large "draw and fill" tank to treat 150,000 gal. daily designed after correspondence with Prof. G. J. Fowler of the University of Manchester, England, is in the course of construction, and plans have been completed for a continuous-flow installation. The Sanitary District of Chicago proposes to initiate tests, and the Illinois State Water Survey has completed a series of laboratory experiments and biological studies, the results of which will soon appear. Iowa State College is considering the question of starting tests, and the officials of the Indiana State Board of Health will probably caution the city of Indianapolis to go slow in its proposed $2,000,000 disposal plans. The joint experiments at Baltimore, noted recently in this journal, will undoubtedly be given the fullest publicity at an early date.

The enthusiasm over the septic tank years ago seems in a fair way to be duplicated and is sure to sweep over the country as soon as it becomes generally known that the resultant sludge is a plant food rivalling dried blood and that the land-consuming sprinkling filters can be eliminated.

Some of the questions of vital importance that have come up are as follows: What is the organism that really does the work? If more than one is available which is the most efficient? Are there summer and winter organisms? Some algæ like cold weather. At Milwaukee a sludge was activated in 48 hours. At other points two to four times this period has been found the minimum. Small worms from 2 to 5 mm. long were found in pure culture at Urbana. Technical literature, of course, is not replete with biological data on the subject, and the life history of these organisms must be known to obtain definite and reliable results. It may, in the end, be desirable to inoculate with pure cultures.

Aside from the purely biological side there are details more or less mechanical, though vital to the life of the organism, which must have thorough study. What, for example, is the best method of agitation? Laboratory tests at Milwaukee indicate that a Poule air-lift arrangement hastens the action. Again, how violent an agitation can the 5-mm worms stand and still work efficiently?

The question of cost, moreover, seems to be one which should receive early attention for a few preliminary figures indicate that the enormous air consumption, even assuming requirements now believed—or guessed at—to be the minimum, will run into large sums for equipment and maintenance.

To the sanitary engineer who as a biologist has tried to cultivate artificially the lower organic forms of algæ, the successful maintenance of a sludge which must have its air bath with the regularity of clock work, assumes almost insurmountable difficulties. The engineer can be trusted, however, to solve these if the many experiments under way and about to be begun demonstrate that the process has decided advantages. One final thought is worth while—that experimenters should freely interchange even preliminary results, so that as soon as possible duplication may be avoided.

Cheap Source of Power for the Contractor

SO far as known to this journal, the Diesel engine has never been tried, or even investigated, heretofore as a source of power for operating construction plant. The fuel economy and low labor cost of operation as compared with other types of power equipment have, however, gained for it marked recognition in marine and industrial service.

Considering total investment and operating cost, the Diesel engine, when used to operate a generator, is as cheap as any present source of electric power, not even barring cheap hydroelectic development. Industrial plants have availed themselves of it—why not the contractor? The latter, in addition, would make a considerable saving in freight due to fuel economy, especially where transportation facilities are poor.

The economies of running a contract with electrically driven equipment are proved and varied. Wiring costs less in materials and labor than steam or air piping, and much less than the carrying of coal to small isolated boiler plants. Electric power, too, can be applied to construction equipment with less loss in use than steam or air—53 per cent less, it has been estimated, as compared with a hoisting engine run by air. Electric equipment, moreover, now costs little, if any, more than steam and air plant.

If then electricity is a satisfactory form of power for the contractor, those undertaking good-sized jobs where 200 hp or more is used in scattered equipment should carefully study this means of making electric power, no matter where the contract may be, more cheaply than it can, as a rule, be bought from a central station.

For most contractors this is not a time for increasing overhead expense by the purchase of costly new equipment. However, the present depression is bound to end. Some firms have already gone far toward electrifying their field equipment. Why not take a further step and avail themselves of a source of electric power which may, except under unusual conditions, be had at a saving on any fair-sized contract in almost any locality?

Shall Connecticut Make a Pork-Barrel of Its Road Maintenance?

THERE is a bill now before the Connecticut Legislature, which, if it pass, will have such a pernicious influence on the development of the State's system of highways that its defeat cannot be urged too strongly. The measure proposes, in effect, to take the maintenance of the State roads out of the control of the highway department, where it now rests, and place it in the hands of the town selectmen. This is nothing more nor less than an attempt to make a "pork barrel" of a highly important branch of public work which is now being administered in a most satisfactory manner by a trained organization of engineers.

The impression of many who have not studied the subject is that a road, once built, is good for an indefinite period, or that if repairs be necessary, almost any one can make them. In the whole category of road building there are no greater fallacies. They, more than any others, have obstructed progress in this field. The road surface is not a permanent structure, and its maintenance, instead of being a task which every Tom, Dick or Harry is competent to perform, demands the supervision of the technically trained specialist. The town councillor with not technical training and with political debts to pay is the last man to entrust with the all-important work of road maintenance. Throughout the country the people are paying, and paying dearly, for disregarding this fundamental requirement of successful road building.

The provisions of the Connecticut measure are so inimical to the best interests of the State that there would seem to be small chance of its becoming a law. Nevertheless such a proposal deserves the widest publicity to prevent its repetition elsewhere. The bill, in effect, vests in the selectmen of 168 towns supreme authority over road maintenance in their localities—with the thoughtful provision that the highway department pay the costs. Thus Commissioner Bennett's plan of centralized control over road maintenance would be completely shattered, and every town would be doing its work differently from the next. By giving to each selectman the power of employing men on this maintenance work—and it is really this patronage feature which commends the bill to its adherents—the State Highway Department would be converted into a powerful political machine, manned by those without special fitness, whose costly blunders the State Highway Department would be called upon to shoulder. Connecticut cannot afford to pay the price of this change.

Investigation of Massachusetts Water Resources

THE desirability of taking account of stock of the water resources of Massachusetts finds effective expression in a recent report of the Harbor and Land Commission to the Legislature, recommending that the board be authorized to investigate during the next three years the conservation, utilization and equalization of stream flow within the State. Interest in water supply for power, industrial and domestic uses has been growing of late in Massachusetts, which is densely populated and extremely active in manufacturing pursuits.

There is good reason to believe that a thorough engineering study of the water resources will afford the basis for developing a comprehensive policy of utilization. At present lack of data and divided control make it almost impossible to lay down broad plans. The Federal Government, the Harbor and Land Commission, the State Board of Health, the Fish and Game and the County Commissioners all have some regulatory functions with respect to streams or ponds. It is surprising that the present large development of individual powers has been accomplished in the face of these conditions, but there has always been a disposition to help deserving projects by special enactments where necessary.

The two phases of the report of chief interest to the engineer are the possibilities of further power development and the opportunities ahead for modernizing existing installations. Data gathered by the commission show that $25,817,000 is expended annually in the State for the purchase of fuel for power purposes and in the direct purchase of power generated outside the various industrial plants. About 264,000 hp are developed at present in the water-power installations of Massachusetts factories having 1000 hp or over. It is certain that a large increase above this total can be realized by engineering study and the construction of reservoirs, not only on some of the larger streams but on their tributaries. Moreover, the importance of cutting down freshet damages and of increasing the average flow of streams needs no demonstration. The annual wage loss through shut-downs caused by high water and by minimum flow runs, in the opinion of the commission, into at least six figures.

The question of modernizing present power plants is one of great interest and is already receiving thoughtful consideration by engineers interested in this branch of the profession. If the report has little to say upon this topic, it none the less recognizes the possibilities, and it is to be hoped that the desired appropriation will be forthcoming to enable the right kind of studies to be made. The layman tends to look upon every stream as a potential source of wealth, overlooking the vast range of detail which must be investigated before any project can be successfully attempted.

In non-technical language the report very clearly sets forth the importance of basing every project for water conservation upon economic, hydrographic, topographic and geological data, emphasizing again and again the absolute necessity of basing the water conservation policy of the State upon thorough studies by competent engineers, which will enable the costly mistakes of superficial and unwise developments to be avoided and establish a foundation for the scientific utilization of resources now running to waste.

Needless to say other States might with advantage take up similar investigations, if they are not already under way. We have learned through European experience that water supplies are not, like the widow's pot of mead, self-replenishing and impossible of exhaustion. There is a limit in the supply and that limit needs determination while the available margin is still large.

Well-Planned Oil-Circulating System

IN the article dealing with the Cohoes hydroelectric development will be found a complete description of the pressure oil circulating system for the governors as well as an outline of the gravity oil system for the thrust bearings. The oil-pressure system represents the latest developments in this line. By having the auxiliary equipment centralized and located near the exciter switchboard the cost of attendance will be reduced to a minimum. Pumps at the units, for supplying oil to the governor servo-motors, have been replaced by tanks, and while several developments abroad have a similar arrangement the tanks have been designed as accumulators, loaded with heavy weights. This, however, introduces too great an inertia into the system, with a decrease in the sensitiveness and response of the regulation. The tanks in the Cohoes development, however, have an air cushion at the top, thus permitting any governor to operate without subjecting the system to severe pressure losses.

It is intended to run the pumps all the time, while the compressor will be used only when it is necessary to replenish the air cushion. As an alternative, the compressor could be run continuously and the pump motors be controlled through switches that would operate as soon as the oil level in the system dropped below a predetermined height. Two advantages favor the alternative method of operation. First, by having a surplus of air, the system is less liable to pressure losses, because of the smaller viscosity and inertia and the greater elasticity of the air. Second, the oil is liable to form an emulsion, which is influenced largely by the churning action of the pumps and the velocity in the mains. Consequently, if the pumping is reduced to a minimum and velocity of flow kept low, the formation of an emulsion will be reduced, effecting a material saving in oil. The system can easily be guarded against overloading by providing a safety valve on a small air receiver near the compressor.

The gravity oil system is used for the thrust bearing, the use of the Kingsbury type making it possible to do away with pressure oil for this service. In fact, this simplification is one of the distinct advantages of the Kingsbury bearing, the saving in power and equipment being considerable. Furthermore, the attention required in operation is less for the gravity than for the pressure supply.

Oil supply is, it is true, but one of many details in a hydroelectric plant, but experienced operators know well that from their standpoint it is one of the most important. The plans worked out at Cohoes show what can be done by a careful consideration of all of the influencing facts, coupled with a determination to make the system as simple as possible, consistent with the service to be rendered.

An Architect in the Lists

CAUSTIC criticism of the bill for licensing Illinois structural engineers has been made by Irving K. Pond, the well known Chicago architect, who, it is interesting to note, is also a graduate civil engineer. With Mr. Pond's criticism of that part of the bill which makes every designer of a building a structural engineer the Engineering Record is in sympathy. The object sought could probably have been accomplished without imposing that title on the architects. With Mr. Pond's acrid criticism, however, of the engineering profession, because the engineers now refuse to let architects deprive them any longer of their legitimate functions the Engineering Record most emphatically disagrees. Mr. Pond makes much of the fact that, from his standpoint, structural engineering is but a minor part of architecture—ranking, he says, with the design and installation of plumbing, of heating, ventilation and lighting and with the provision of proper protective painting for the structure. One may concede that there is some truth behind Mr. Pond's idea, though he tries to belittle the engineer, when the structure in question is of an elaborate character; such as, an office building, a theater, a public building.

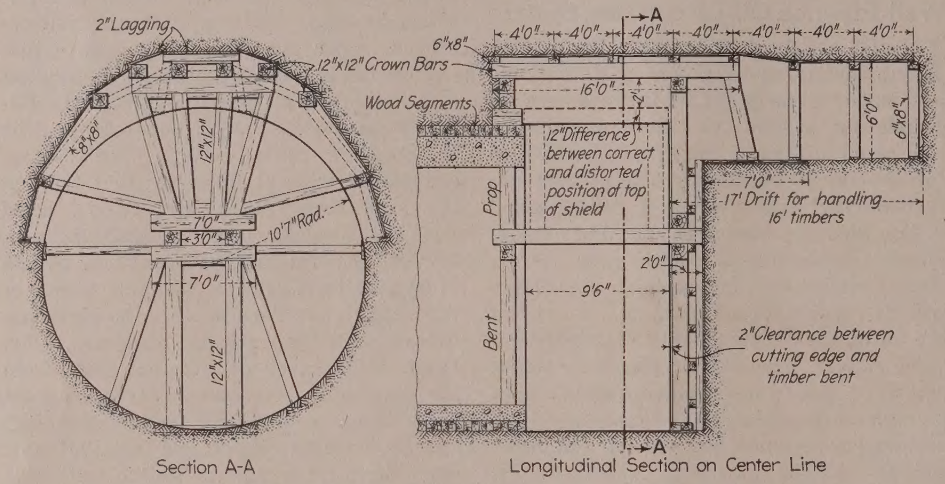
That the architect has a function, however, comparable with that which Mr. Pond claims in designing mill buildings is far-fetched. Yet the architects in Illinois for more than a decade have prevented the engineer from exercising his legitimate function in the design of mill, factory and shop buildings. Now when the oppressed refuses longer to remain in that position, the architect rails and contends that the engineer has no conception of the functional nature of architecture, which, as Mr. Pond defines it, is a "great organism developing upon principles of correct relationship of part to part—of part to whole—and beyond that the fitting of that whole into a scheme of culture and civilization." Certainly the structural engineers in Illinois have no intention of superseding the architect where the latter has a legitimate function, and will, as in the past, gladly work in harmony with him on those projects where he should be in supreme command. That they will not be swerved from their course by Mr. Pond's tact words needs no assertion here. Feeling as strongly as he does about the matter, Mr. Pond might assist in removing all objection by joining the engineers in a movement to have the law licensing architects repealed. That would be, by far, the best way out of the difficulty.

Collapsed Tunnel Shield at Memphis Rebuilt in Bad Ground

After Serious Cave-in in Soft Ground, Deformed Shield Is Restored and Strengthened, and Tunnel Driving Renewed

By C. H. HOLLINGSWORTH
Superintendent, Southern Asphalt & Construction Company

A STEEL-SHELL shield, with which it was proposed to drive 1800 ft. of 16-ft. circular tunnel for a concrete-lined sewer at Memphis, collapsed after penetrating about 70 ft. from the tunnel portal, and caused a serious cave-in. There was no time to build a chamber, remove the old shield, and set up a new one. Therefore an adequate system of steel bracing was ordered for the old shell, the shield cleared, straightened and braced, and tunneling with it resumed.


2" Lagging
6"x8"
12"x12" Crown Bars
Wood Segments
8"x8"
12"x12"
7'0"
3'0"
10'7" Rad.
7'0"
12"x12"
A
4'0"
4'0"
4'0"
4'0"
4'0"
4'0"
16'0"
12" Difference between correct and distorted position of top of shield
Prop
6'0"
6"x8"
7'0"
17' Drift for handling 16' timbers
2'0"
9'6"
Bent
2" Clearance between cutting edge and timber bent
A
Section A-A
Longitudinal Section on Center Line

HEAVY TIMBERING GIVES CLEAR SPACE FOR RECONSTRUCTING SHIELD

The city of Memphis is at present engaged in the construction of a system of main storm water sewers for the purpose of flood prevention, including among other work this 16-ft. circular concrete sewer with 22-in. walls. This part of the work is being built in tunnel, with from 15 to 55 ft. of cover. It was decided to do the work with a shield, and to support the ground behind it with 8-in. wooden segmental blocks. This required a shield of about 21 ft. 1 in. in inside diameter. The shield was built in a local boiler shop, and was of extremely light construction. The skin was made up of ⅝-in. plates, and with the exception of four 10-in. I-beams supporting the two working platforms there was no inside bracing. The shell was reinforced, however, around the inside by means of 12-in. channels bent to a circle with backs outward, and bearing against eighteen 6-in. I-beams, 3 ft. long, which were bolted longitudinally to the skin. The forward ends of these I-beams were 18 in. back from the cutting edge of the shield and the rear ends 5 ft. from the tail. A 4x4x⅜-in. angle circle was riveted to the skin at each end of the I-beams. It was against the rear angle of these two that the jacks bore when shoving. The joints in the skin plates were lapped instead of butt-strapped. The shield was moved forward by means of eighteen 5-in. diameter hydraulic jacks, using hydraulic pressure at 3000 to 5000 lb. per square inch. It weighed complete about 16 tons.

COLLAPSE OF SHIELD

The shield was operated for a distance of about 70 ft. to a point where there was 55 ft. of cover. At this point the face was very treacherous, and considerable ground was lost, allowing the full weight of the ground clear up to the surface to come down on the shield. The shield promptly collapsed. It had also been forced into the ground and into planking on the tunnel face until the platforms were crumpled up. It seems that when 5000 lb. was not sufficient to force the shield ahead, the safety valve and automatic stop on the hydraulic pumps were removed, and as high as 8000-lb. pressure used.

PLAN OF REPAIR

When the shield had been cleaned out, and the space ahead of the cutting edge timbered up, an examination was made. The shield was so filled with temporary bracing that it was difficult to make exact measurements. However, its original dimensions were known, or suspected, and as time pressed it was not possible to wait for these measurements till the shield could be restored to shape. The writer designed a system of interior bracing and reinforcing, using only the outer skin of the old shield. More satisfactory results might have been obtained by building a new shield, but as time was limited it was not advisable to stop to remove the old shell and build a chamber in which to erect a new one. The inside diameter of the shell was supposed to have been 21 ft. ¾ in., and the new reinforcing rings were designed with an outside diameter of 20 ft. 11¾ in., so as to fit easily inside it.

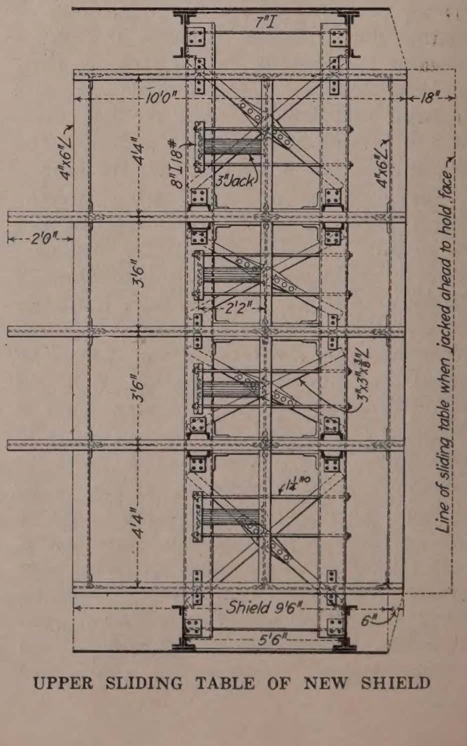
These reinforcing rings, of which there were two, were made up like plater girders with a web plate ⅝x15½ in., two 3x3x⅜-in. angles on the inner edge of the web, and two 3x3x⅜-in. angles covered with a 7x½-in. plate on the edge next the skin. These rings were made in eight segments of equal length for convenient handling, the ends of the segments being milled to a fit, and joined with two 8x12-in. splice plates. One of these rings was 12 in. back from the cutting edge, and the other 5 ft. 6 in. back from the first, bringing the rear edge of the angles of the second ring about 30 in. from the tail of the shield. Horizontal cross-girders bracing these rings and carrying the working platforms ran across the shield, one pair 3 ft. 6 in. above and the other 3 ft. 6 in. below the center line. Each of these girders was built up of two 10-in. channels placed facing each other, and laced with 2¼x5/16-in. bars, reinforced with cover plates at various points. Two sets of vertical columns 3 ft. 6 in. each side of the center line ran from bottom to top, supporting the cross girders at two points. Between the reinforcing rings, and riveted to them, were placed thirty-six 7-in. I-beams, their webs being normal to the skin of the shield. In the rear reinforcing ring eighteen 8-in. circular holes were cut for the jacks.

WORKING PLATFORMS

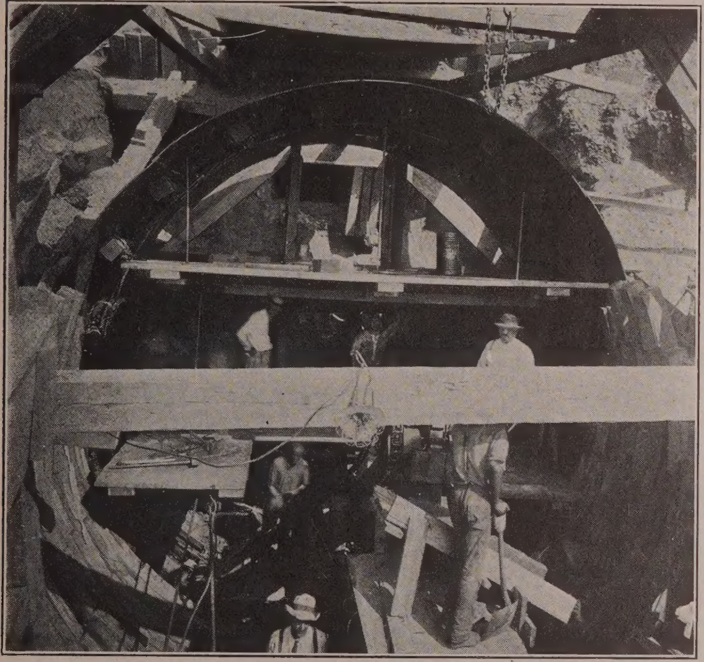
Sliding platforms were provided by running 8-in. I-beams 12 in. long through the two posts on top of each pair of cross-girders, and running one more 12-ft. I-beam through clips on top of the girders on the center line, and two other 10-ft. beams through clips 7 ft. 10 in. each side of the center line. From a point 6 in. ahead of the cutting edge back to the rear end of the shield these beams were covered with ⅜-in. plates. These tables could be thrust forward 18 in. by means of the four 3-in. hydraulic jacks located under each of them. The platforms were located so that they never overhung the forward girder more than 33 in. As the two cross-girders of the shield under each platform would have to take all the thrust from the ground and would also be jacked from in sliding the tables ahead, they were X-braced together to form a truss. At the junctions of the vertical columns and the cross-girders short kneebraces were used to help support the platforms.

CLEARING THE SHIELD

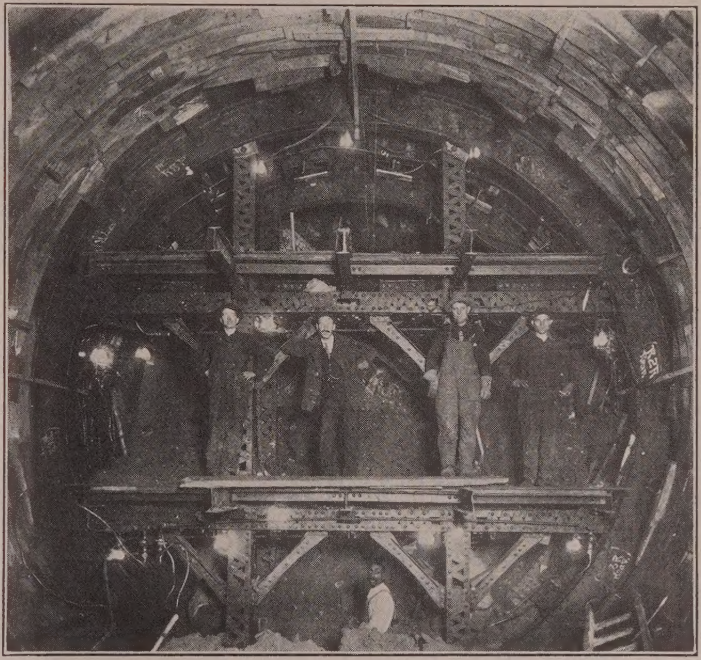
While this material was being fabricated it was necessary to get the skin of the shield into its proper shape. To do this it was necessary either to excavate a chamber ahead and shove the shield into it or excavate around and above the shield down to the springing line. The latter method was chosen, for although considerably more difficult it did not require so much time.



UPPER SLIDING TABLE OF NEW SHIELD



CLEARING COLLAPSED SHIELD AFTER FIRST CAVE-IN



REBUILT SHIELD CARRIES TUNNEL AHEAD WITH SAFETY

Compare light bracing on left with solid construction of rebuilt shield on right. Notice wood segments used to line tunnel outside of concrete

The method of timbering the ground to take the weight off the shield was as follows: A heading on top of the shield was driven from the cutting edge back to the old concrete. In this heading were set two crown bars, with one end resting on the old concrete, and the other blocked from the ground at subgrade ahead of the shield. The hole on top of the shield was then widened on both sides down to the springing line. This was anything but easy.

First of all the face had to be cut out 2 ft. ahead of the cutting edge and planked for the full depth, to allow room for shoring the forward ends of the crown bars. These planks were placed beginning at the top and blocked temporarily to the shield. Vertical 6x6-in. studs were then set against these planks and 8x8-in. horizontal wales run across them. The whole was then braced by 8x8 stretchers extending through the shield back to the old concrete, and the blocking between the face boards and the shield removed. This work was rendered more difficult by the conditions which the cave-in had caused at the face. The upper 7 ft. of the face had originally been clay, and the rest of the face loose, running sand. This material was mixed, however, with wet, flowing clay mud, which had been dumped into the hole at the top of the ground, and had worked its way down to the tunnel level.

Clearing Inside of Shield

After the face had been caught up the skin of the shield was timbered with radial braces from two needlebeams just above the center line, which in turn were supported on heavy 12x12-in. timber bents in front of and behind the shield. When this timbering was in place, all iron inside the skin of the shield was removed. Rivets were burnt off with an oxyacetylene torch and all long pieces were cut up by the same means to facilitate handling. The next step was to break into the ground above the shield. By working carefully up through the broken ground a hole about 2 ft. x 3 ft. was raised 3 ft. above the top of the shield at the cutting edge. This was widened out and a 4x6-ft. drift started ahead from the cutting edge. This drift had to be excavated 18 ft. to permit the 12x12-in. crown bars 16 ft. long to be slid ahead far enough for their rear ends to clear the cutting edge. The crown bars were slid ahead into this drift, their rear ends raised above the shield, and slid back into place over the shield. In driving the drift over the top of the shield the planking was braced to the shield. When the crown bars had been placed this bracing was removed, and the crown bars wedged up. The plank on one side of the drift over the shield was removed and the drift widened out for another crown bar. The bar on the side first opened was placed before starting excavation on the other side. Eight crown bars in all were placed, four on each side of the center line. The forward ends of these bars were shored to the timber bent carrying the needlebeams which supported the inside of the shield. This bent cleared the face of the shield by 2 in. Stretchers were placed between the crown bars every 4 ft., and the lowest bar on each side was supported by four vertical legs resting on blocking at the springing line. The clearance between the top timbering and the sheild was 1 ft.

Repair of Shield

The shield had flattened out about 12 in. on top, but when the weight was removed from it the shield plates sprang back about 6 in. The cutting edge was battered in a dozen places, and the shell was forced inward badly at two of the longitudinal seams. The kinks in the cutting edge were straightened out while the excavation was in progress by means of two 25-ton ratchet jacks. The new steel bracing was set to a center taken as 10 ft. 7 in. above the inside of the bottom plate. Starting at the bottom, the segments of the rear rings were set without trouble until the last two were ready to be placed. Although there should have been an inch play around this ring, these two plates overlapped by ½ in. The skin of the shield had been made of three rings of plates with lap joints, and it developed that these rings had been made to telescope, making the diameter of the shield at the cutting edge 2½ in. greater than the diameter at the tail. After the tail of the shield had been brought to a true circle a 25-ton jack was placed against the end of each of the segments, which still overlapped a quarter of an inch. When these segments had been forced back, two other jacks placed on opposite sides of the ring forced them sideways into position, and they were bolted up. The front ring was erected without difficulty, and required a 1¼-in. filler plate all around and numerous short plates to make it tight with skin. When both rings were in place the I-beams between them were set and bolted to the ring. Rings and I-beams were attached to the skin by bolts. Machine bolts were used on top where the outside of the shield was accessible, and tap bolts on the bottom. Only a few of these holes could be reached with the electric drill, and most of them had to be drilled with a hand ratchet. In all about 2000 ¾-in. holes were drilled in this way, one-half of which had to be tapped. New double action jacks were bought to replace the old ones, which were single action.

The writer took charge on October 26, repair work was started on November 1, and the first shove with the reconstructed shield was December 16. At present (January 15) the shield is working satisfactorily, although the skin plates are too light and show a tendency to buckle on striking the slightest obstruction. The old shield complete weighed about 32,000 lb., of which 16,000 lb. was in the skin plates. The new steel added weighed 46,000 lb.

This work was designed and carried out by the writer as general superintendent for the Southern Asphalt & Construction Company, contractors for the sewer system. The work was done by the three regular shifts in the tunnel, under the charge of W. B. Converse, R. E. Mosier and M. Jackson.

California has 30,000 sq. mi. of forest, covered with 381,250,000,000 ft. of timber valued at $700,000,000, according to G. M. Homans, State forester.

Concrete Materials Tested in a Jones-Talbot Rattler

Specimens Made with Hard Pebbles and Laminated Rock Kick Out Easily and Give Less Service than an Even Surface

A STUDY of the road-making properties of the aggregate which goes into concrete has been made at the University of Minnesota by means of a Jones-Talbot brick rattler into which was fitted rings of concrete with 8½-in. faces. The details are to appear in a forthcoming bulletin, but Prof. C. F. Shoop outlined some of the tests recently to the Minnesota Society of Engineers and Surveyors. One of the tests includes the effect of different methods of curing. Another has to do with comparisons of broken stone and gravel.

It was found in the case of the gravel specimens that when subjected to the action of the shot the gravel would kick out and produce pockets, and that once formed these pockets would quickly develop into holes. It was also noted that for the hard and tough stones, when used in comparatively large sizes, the bonding mortar would wear away and allow the rock to protrude, making an uneven and bumpy surface.

Protruding Stones Kick Out

It was further found that where the stone presented lines of cleavage, as is present in many hard stones, the protruding stones would laminate and then kick out. Deep pockets were formed when the laminations ran vertical. The part of the stone between the laminations was easily dislodged, as the remainder of the broken stone had no backing of material and as a result the entire stone was dislodged. The softer mortar would then break down, followed by the stones circling the pocket, and the small pocket would very speedily develop into a much larger pocket. When the laminations ran horizontal the pockets formed were more or less shallow and the unevenness of the surface was not so pronounced. In the crushed stone specimens this condition of surface was developed at a much later period.

It was demonstrated in the case of the sandstone specimens that the stone wore down with approximately the same rapidity as the bonding mortar, producing a smooth, even surface. It was also observed that the percentage of wear was normal. This would not necessarily be true concerning all sandstones, but for the one tested the evidence presented substantiated the statements made.

The Best Material

It is believed, said Professor Shoop, that a material which will wear at about the same rate as the cement mortar itself, insuring a smooth pavement, will in the end be the most economical, even though its coefficient of wear be greater, which is not true in this case. This probable increased coefficient of wear will be more than counterbalanced by the wear due to the hammering action produced by the heavy traffic rolling over the protruding stones and tending to break up the roadbed. In all probability, therefore, its maximum life will be greater, and in addition will afford an ease and pleasure in travel with the absence of the unsightly and annoying pockets.

If the stone used is harder than the cement mortar it should possess the property of gradually wearing away, and should not crack off in spalls running below the bonding surface of the incasing mortar, producing pits which later develop into pockets.

Professor Shoop made it plain that his discussion covers only the cases where the concrete itself receives the direct wear of traffic. When the surface is protected by a special coating, or covered by loose material, conditions would be different.

While considerable experimental work has been done with this machine, it has not progressed sufficiently far to arrive at standards or to show its qualifications sufficiently to recommend its adoption for standard testing purposes. It is not claimed that the laboratory tests furnish the actual road-wearing conditions, climatic and other changes being absent, but it is believed that the relative merits of the constituents, grading, proportioning and mixing can be determined by the methods employed.

Further Views on Status of Engineer

Continuation of Discussion on Paper Read by Professor Swain before American Institute of Electrical Engineers

IN the last issue of the Engineering Record, page 361, were presented the views of a number of eminent engineers on the paper on the status of the engineer read by Prof. George F. Swain, of Harvard University, before the American Institute of Electrical Engineers, Feb. 17. Since then contributions have been received from Henry W. Hodge, of Boller, Hodge & Baird, consulting engineers, New York; from Dean Anson Marston, of Iowa State College, Ames, Iowa; from Frederic Bass, professor of municipal engineering, University of Minnesota, and from a professor of engineering in a Middle Western University who wishes his name withheld. There are also given here the comment of J. Vipond Davies and a consulting engineer who asked that his name be not used, these two comments being held out of the last number for lack of space.

As in the last issue, the general contention here is that the early education of the engineer should be broadened. Mr. Davies sees in the first work of engineers a narrowing influence, while Mr. Hodge aptly says that "leadership consists in seeing what is to be done and selecting the men who can best do it." Professor Bass believes that the engineering societies can exercise an influence in broadening the engineer's outlook, while the professor of engineering holds that in the Middle West engineering students grade up well with those in law and medicine. The other communication not signed expresses the view that the engineer will not be prominent in public life "so long as political preferment is dependent upon the man seeking the office rather than upon the office seeking the man."

The comments follow:

Mr. Davies Points Out Narrowing Influence of Constant Handling of Engineering Details

It gives me much pleasure to add a word of appreciation of Professor Swain's paper and to express my general agreement with what he has said.

To my mind the cause of the trouble to a considerable extent goes back to the education of the engineer, and the schools are very largely responsible in too elaborate specialization in the early curriculum. The work and duty of the engineer is a devotion largely to detail, which to a large degree causes a constriction of ideas, as by the very nature of his work the engineer is drawn out of contact with other peoples and professions and naturally obtains a narrowing experience of life, which in itself is most detrimental to his general qualities for leadership.

Early Education Should Be of Broadest Character

If the character of a man's work in his later years is necessarily so absorbing, then the early education should be of the broadest character possible and professional specialization should not begin during the period of education. The lawyer and the doctor are continuously brought into contact with other people and other lines of endeavor and the whole aftertendency is to give breadth of view. The engineer, by the very character of his work, has not the same advantage. There is, therefore, to my mind, too much specialization, with consequent narrowing of views, in the ordinary college training.

The colleges, too, commonly narrow their training to a single branch of the profession, and will have separate schools for electrical, mechanical and civil engineering and other multitudinous branches of the profession, whereas, as a matter of fact, the underlying principles of engineering are the same in all branches and what is needed is the broadest possible education, to fit a man for later taking up whatsoever branch he desires.

Further, it is essential that the education of the young man in the learned profession of engineering should include a considerable degree of culture, such as is obtained more commonly by the student of law or medicine. This specialization in the schools of engineering at the expense of the general education in arts and science is later hurtful to the engineer, because so often he leaves his college or school ill equipped in general education to write clear, logical reports or to direct the general administration of affairs. The place for the young engineers to obtain all this is in the colleges; and if they so specialize that they acquire little education besides the details of engineering practice and theories, it is little wonder that the young men are not properly equipped when they leave college and settle down to confining detail with the broad learning which is necessary to the development of the practising engineer.

Education in Cost of Work

In the ordinary technical training in the colleges, education is considered solely from the theoretical point of view, whereas, in the practical application, cost and value of work executed intelligently and economically are all important factors. Economics have a large bearing in the study of all engineering work. This is seldom, if ever, taught in the colleges, possibly because the teachers themselves so seldom know anything of the value of the work.

This narrow technical college training in multitudinous branches of engineering limits seriously the horizon of the student, with the obvious result that he feels that he has been taught only one line of the engineering profession and is unable to take up any other work for the reason that his experience and knowledge have been from the beginning so restricted. The responsibility of the college in the training of the student should be broadened rather than narrowed.

CONTRACTS AND SPECIFICATIONS

There are many subjects which the engineer working in his profession finds it very difficult to acquire, and which should be taught as an essential part of an engineering course. As an illustration, every practising engineer entering responsible work faces the necessity of interpreting contracts and preparing specifications, which necessitate general knowledge of the principles of commercial and contract law. Every practising engineer is faced by the necessity for a clear understanding of the theories of finance and banking and such allied subjects. I doubt if any of the colleges attach sufficient importance to the teaching of such subjects. Again, it would have been most advantageous to a practising engineer to have been taught early the principles of promotion and financial arrangements of corporations.

Leadership in the profession requires, first and foremost, the willingness and ability to take personal responsibility. To produce such men, obviously the broadest education and training of the young engineer must be adopted. This is the age of specialization in all lines, but, the specialization in engineering should be postponed as long as possible during the education period for the obvious reason that, as before stated, the whole work of the engineer is in its very nature absorbing and narrowing, and takes one necessarily out of contact with those influences which would in themselves be broadening.

YOUNG MEN MISDIRECTED

It is an old saying in Europe that in a family of boys the eldest enters the army, the second goes into the navy and the fool goes into the Church. This is not quite applicable, but at the same time it is quite common for families to consider that any boy who shows a liking for tools, however ill fitted or equipped he may be, must be desirous of going into the engineering profession and it is probable that, as a consequence, numbers of boys enter the profession who are quite unfitted for any possibility of success. I have in my own knowledge seen a number of engineers filling more or less important administrative positions who have made ill success in the positions they have been called to fill, for one reason, if for no other, that they cannot leave the unimportant detail to others, but must carry with them the long years of professional training in the minutæ of engineering, instead of forgetting these unimportant matters and applying themselves to the broad principles of administration.

My feeling, therefore, is very strong that to the schools we must look for broader and bigger ideas in the education of those who are to become engineers, and to our technical societies for the inculcation of higher standards of practice and ethics, and to those societies also, to instill into the engineer the better appreciation of his value to the community so that he may in turn command what he is justly entitled to—a better recompense for his services and a more important position in the administration of the affairs of the community.

Former Railroad Engineer and Executive Believes Engineer's Standing in Professional and Business World High

I have been much interested in reading Professor Swain's address and your comments thereon. I find myself in accord with the general proposition that the engineer, as a class, has not won from the public the same recognition for leadership as is the case with some of the other professions, but I am not prepared to admit that he is deficient in capacity for straight thinking or sound reasoning.

INDEX OF LEADERSHIP

Taking "Who's Who in America" as a fairly accurate index of leadership in this country, it would appear that the number entitled to that standing per 1,000 of those engaged in each profession is somewhat as follows:

Law	27
Art	19
Theology	17
Technical (engineers and architects)	8
Medicine	7
Music	2
Average of these professions	11

These figures bear out Professor Swain's opinion that the engineer is not forging to the front as fast as he should, but I incline to the belief that this is not due to a deficiency in natural qualifications. In the strictly professional and business field it is my opinion that he at least holds his own, while in public service his undeniable backwardness lies in his lack of touch with the mass of men and in his aloofness from political activity.

In the broad field of human endeavor it does not appear to me that the engineer lags so far behind his brethren of the other callings. In the inception, development and administration of railroads, certainly he has given no evidence of a lack of the qualities of real leadership, and in manufacture and invention his genius and creative skill have been foremost. Then, of course, in the great works of construction he has displayed intellectual powers of the highest order.

LACK OF CONTACT WITH PUBLIC

In considering the lack of recognition of the work of the engineer by the general public, sight should not be lost of the fact that he does not come into personal contact with the great mass of the people as does the lawyer, the physician, the theologian or the artist. The very nature of his work tends to isolate him from his fellows, and this, combined with his disinclination to enter the devious course of politics, beyond question bars him from a prominent place in public life. This is unfortunate both for the engineer and for the public, but I see no remedy so long as political preferment is dependent upon the man seeking the office rather than upon the office seeking the man.

If these views are well taken, the absence of the engineer from leadership in public affairs would seem to be due to causes other than his incapacity for straight thinking and sound reasoning.

RAISING ENGINEER'S STATUS

Summarizing, my observation and experience have led me to believe that the engineer, in the professional and business world, stands high; but that in public life his influence has counted for naught, not through his lack of capacity, but from his absence of desire to strive for office and his lack of touch with the masses.

The further lifting of the status of the engineer would seem to lie in a more thorough grounding in the fundamentals of education, more attention to the need for ordinary accuracy, training in the art of public speaking, and a wider interest in the broader fields of his profession and in the affairs of men outside of the narrow confines of the specialty that may claim his attention in the earlier stages of his career.

Mr. Hodge Believes That Breadth Is Acquired After Leaving College

I fully agree with Professor Swain that engineers, as a class, do not receive as much public recognition as the members of other professions, because they, in general, have not the personal qualifications that appeal to the public. I also agree that the reason lies largely in the strictly technical education given in our engineering schools, but this is almost impossible to change unless the course of training can be lengthened, and most young men cannot afford to spend more than four years in their college education.

Engineers, to attain leadership, must have a breadth of training and a polish that will enable them to impress educated men of other callings with their knowledge, not only of their own subjects, but also of all subjects of general interest, and they must show their ability to see great problems in their broadest aspects.

This breadth and polish is not acquired in one's college course, but is attained by contact with other men and by thinking outside of the narrow technical lines that an engineer has to follow in reaching many of his conclusions.

The engineer will also have to learn that leadership consists in seeing what is to be done and selecting the men who can best do it, as in many cases engineers have made poor leaders because they tried to attend to the details and lost sight of the fact that the duty of a leader is to lead.

There is no doubt that an engineering training fits a man for leadership, if properly rounded out by the other necessary personal characteristics, and this has been proved by the success of some of our largest public service corporations, controlled almost entirely by men of engineering training.

Dean Marston Is Confident That Engineer's Opportunities for Leadership Are Becoming More Numerous

I have read the report of Professor Swain's address with much interest. Personally, I believe engineering to be the greatest of professions and that more and more the engineer is coming to his own and to high recognition.

Important changes in engineering and the place it holds in our general economy are now taking place which are as yet little recognized by engineers themselves. These changes require men of the highest qualifications and I am entirely in sympathy with any influence which brings home to engineers more vividly the importance of qualifications such as those discussed by Professor Swain.

Our engineering schools in particular cannot hold up too high ideals before the young men who are beginning the process of becoming engineers.

In this State a new road law was passed two years ago which puts an engineer in every county, with responsible oversight and direction over all the road and highway bridge work, which necessarily makes him, if successful, a leader in county affairs. The men of the different counties are responsible in an important degree to a central State body, the Highway Commission. They meet at intervals for a discussion of the details of the work. They are developing an esprit de corps and a devotion to their professional work which cannot help but do much to develop them, both as professional men and as leaders.

I feel that this is only one instance of the many changes going on in the country at the present time which are giving the engineer actual experience in leadership.

Professor Bass Holds That Engineering Societies Can Help to Broaden Profession's Outlook

I have read Professor Swain's analysis with great pleasure. It is true that the students in the engineering colleges have a tendency to disregard the broader aspects of engineering and to give their attention to details, but I cannot help but think that this is right, for at the age of 20 years a young man cannot grasp the interplay of all the forces active in human affairs which make for progress.

The broader view of the profession and its duties must come later, and it seems to me that more attention to these things might well be given by the various engineering societies. If that were done more generally I think engineers would realize more than they do now what they might do for the benefit of mankind. They need not only to *stand* ready to meet the needs of other people as those people realize them, they should be *moving* and moving together. No group of men can be leaders unless they know where they are going and how they are to get there. The human race develops, and engineers in their societies must study the tendencies of development, anticipate the goal and work out the path of least resistance and demonstrate their solution to the rest of the world.

Whoever solves the problem of human progress first and clearly points it out will by that act become a leader. If the engineering profession can get together and do this it will lead. Take the labor problem, for instance. What industries do we need today? What kind of an organization do we need to establish them? What are the markets? What are the obstacles, human or otherwise? How are they to be overcome? What are the engineering, commercial and financial difficulties? Some set of men is going to solve this problem, and who is more interested than engineers? Why shouldn't the engineer look abroad and ahead, and at least aid, if not actually lead, in this foremost human problem? It will take him into sociology, into common-school education, into economics and law, but if he is to lead he must understand the fundamentals of these subjects.

Professor of Engineering Attributes Backwardness to Early Employment of Engineers

While many of the things Professor Swain says are true, I do not agree with him altogether on causes for the condition described. I am certain that in the universities in this part of the country, at least, the natural ability of students taking engineering courses is just as high as those who go into other courses. Certain it is that in this institution (in the Middle West) the reputation of engineering students for all-round ability is quite as high as of any other group.

I think, too, with few exceptions, the training which lawyers and doctors have received in schools up to recent years has been quite as narrow as that received by engineers. Long courses of study now required in many law and medical schools have scarcely had time to show their effect, as the "leaders," whom Professor Swain has in mind, have had little opportunity to profit by such courses. This is true, at least, in this part of the country. Furthermore, the business man, mentioned by Professor Swain, has probably had less schooling of any kind than the average college graduate.

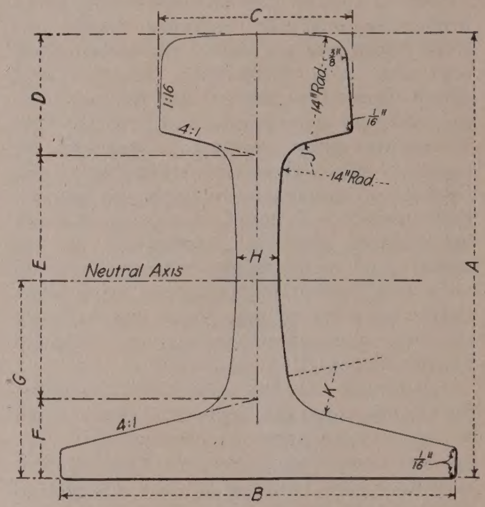
Early Employment Narrowing

If it be assumed as correct that engineers as a class are not taking positions of leadership to the extent desirable, I think the cause is to be sought, not in their school training, but in the sort of work which the average engineer is employed in during the first ten or fifteen years after graduation. I think a study of the opportunities for the development of those faculties necessary for leadership which naturally come to young men in the different professions will explain, to a large extent, the difference in ultimate results, especially in matters of public discussion.

I believe that it requires a very considerable special effort on the part of young engineers to develop and maintain relations with men and affairs as will ultimately be to their best interests. I think a college can do something to help by cultivating students' interests in a broad way, and should do so. But the chief cause of the difficulty is, in my judgment, something very different than the kind of college training and something very hard to overcome.

Rail Committee Presents Six New Rail Sections

THREE new rail sections, for weights of 100, 110 and 120 lb., were adopted at the recent convention of the American Railway Engineering Association. The rail committee also submitted, without recommending their adoption, 130-lb. and 140-lb. sections. The 90-lb. A-section of the American Railway Association was also approved, as recommended by the committee. The accompanying diagram and table give the dimensions of the six sections.



Dimensions of Standard Rail Sections

	Weight, pounds per yard											
	90		100		110		120		130		140	
Distances, inches												
A	5 5/8		6		6 1/4		6 1/2		6 3/4		7	
B	5 1/8		5 3/8		5 1/2		5 3/4		6		6 1/4	
C	2 9/16		2 11/16		2 25/32		2 7/8		2 15/16		3	
D	1 15/32		1 21/32		1 23/32		1 25/32		1 27/32		1 29/32	
E	3 5/32		3 9/32		3 13/32		3 17/32		3 11/16		3 27/32	
F	1		1 1/16		1 1/8		1 3/16		1 7/32		1 1/4	
G	2 35/64		2 3/4		2 53/64		2 59/64		3 1/32		3 9/64	
H	9/16		9/16		19/32		5/8		21/32		11/16	
J	3/8		3/8		3/8		3/8		1/2		1/2	
K	3/8		3/8		5/8		5/8		3/4		3/4	
Areas:	sq. in.	per cent	sq. in.	per cent	sq. in.	per cent	sq. in.	per cent	sq. in.	per cent	sq. in.	per cent
Head	3.20	36.2	3.80	38.2	4.04	37.4	4.40	37.1	4.63	36.4	4.93	36.3
Web	2.12	24.0	2.25	22.6	2.49	23.0	2.69	22.7	3.02	23.8	3.28	24.1
Base	3.50	39.8	3.90	39.2	4.29	39.6	4.76	40.2	5.06	39.8	5.37	39.6
Total	8.82	100.0	9.95	100.0	10.82	100.0	11.85	100.0	12.71	100.0	13.58	100.0
Moment of inertia	38.7		49.0		57.0		67.6		77.4		89.2	
Section modulus, head	12.56		15.1		16.7		18.9		20.8		23.1	
Section modulus, base	15.23		17.8		20.1		23.1		25 6		28.4	
Ratio M. I. to area	4.39		4.92		5.27		5.71		6.09		6.56	
Ratio sec. mod. to area	1.42		1.52		1.55		1.59		1.64		1.70	
Exact weight, lb. per yard	89.96		101.49		110.36		120.87		129.64		138.52	

Preventing Corrosion of Iron and Steel in the turbines, gates and racks of the Holtwood plant of the Pennsylvania Water & Power Company, where the amount of acid in the water of the Susquehanna River is excessive, has been a difficult problem for the engineers. After several experiments it has been found that galvanization of parts in contact with the water prevents such corrosion. The new turbine, therefore, described elsewhere in this issue, together with its governor piping, which uses filtered river water, all valve bodies and the accumulator tank, have been galvanized.

Kinks in the Control of Hypochlorite

Hydraulic Mixers, Specially Graduate Scaled Boards and Constant Head Barrels Instead of Orifice Boxes Are Features of the Plant at Denver

HYDRAULIC mixers of the type used in cyanide plants are employed to dissolve and mix bleach in the four installations which sterilize the water supplied by the Denver Union Water Company. Other novel details of these plants include the graduation of the scales on the solution tanks in pounds of solution and the control of the flow from the constant head box by special long-lever controlled plug cocks, stated W. W. DeBerard in a paper presented before the Illinois Section of the American Waterworks Association March 10 at its meeting held at Urbana.

In the arrangement at Willard, where there is a 10,000,000-gal., rapid filter plant, two horizontal solution tanks, 12 ft. long, set 5 ft. on centers, are made out of 48-in. wood-stave pipe. Above one end of these tanks is a mixing tank consisting of a 50-gal. barrel with the necessary inlets, outlet pipes connecting the mixing barrel with the solution tanks, water supply and drain. To agitate the chemical with the water in the mixer barrel, a 1-in. pipe entering at the bottom is reduced to a ½-in. nozzle which extends up into a 2-in. four-way cross. The side outlets of the cross are open. From the top outlet a 2-in. pipe extends above the top of the barrel and terminates in a tee into which are screwed nipples and turned-down elbows. The discharge is thus given a downward motion. A branch carries part of the supply through the side of the barrel about 2 in. above the bottom. A 45-deg. elbow with a ¼-in. nozzle on the inner end of this pipe gives the solution a whirling motion which throws all of the sediment to the center.

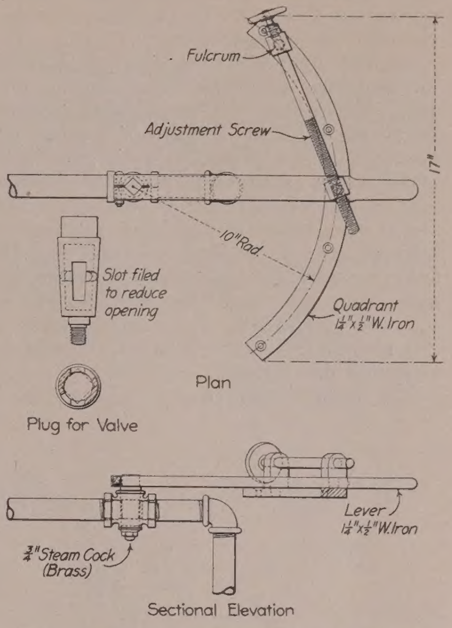
OPERATION

In operation enough of the dry chemical is weighed out to make up a 1-per cent solution and is dumped into the barrel, which is full of clear water. Filtered water under 75 lb. head is then turned on. The jet action of the water entering the tee at the bottom of the barrel pulls water and undissolved chemical into the central pipe, or hydraulic elevator, as it is called, and discharges it at the top. The swirling motion of the water entering at the side of the barrel rolls the undissolved chemical constantly toward the center, where it is drawn into the elevator by the injective action of the water entering through a ½-in. nozzle pipe. Screens prevent lumps from passing to the storage tanks through the 2-in. overflows.

In half an hour practically all of the hypochlorite is discharged from the hydraulic mixer, and the storage tank will be one-half to two-thirds full. The remainder of the clear water to make up the solution to proper strength is brought into the bottom of the tanks midway between the bulkhead ends. Two-foot lengths of pipe terminating in ½-in. nozzles are screwed into a tee on the inlet pipe to give an additional mixing by the swirling motion produced. Numerous tests at the surface, center and bottom of the storage tank after standing eight hours indicate a variation of less than 0.43 per cent.

SCALES READ IN POUNDS

Solutions of 1-per cent strength are invariably used. A glass gage on the end of the tank is graduated to read directly in pounds of chemical. Readings of the gage are taken at one-hour intervals and adjustment is made if the necessary quantity is not feeding. By having the scales read in pounds a very simple calculation, as outlined in the Engineering Record of July 25, 1908, page 99, gives results, in grains per gallon, sufficiently accurate for all practical purposes. The expression pounds used between readings divided by the product of the minutes between readings and the rate of flow of the treated water expressed in million gallons per day gives, within 1 per cent of the correct figure, the grains per gallon applied. Following the recent practice of expressing results in pounds per million gallons, the weir scales have been calculated to read in gallons per hour, so that one division gives results at once, the solution tank being read every hour.



ADJUSTMENT SCREW REGULATES FLOW

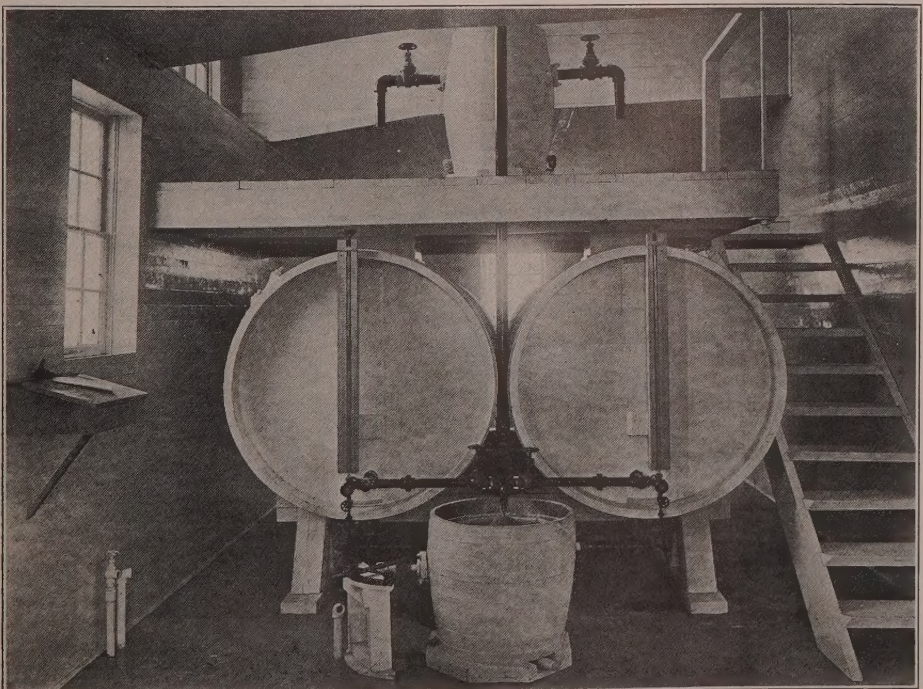
Graduation of the scale is accomplished by actually weighing into it 200 lb. of water from a small barrel resting on a scale. Points are marked on the scale board after each addition. Graduations between these intervals are interpolated down to 10 lb. of water, which, with the 1-per cent solutions used, means 0.1 lb. of chemical. A 4 x 4-in. pine stick is grooved to admit the ½-in. glass gage flush with the outside. The pound marks, about ½ in. apart in the center of the tank, extend across the face of the 4 x 4-in. stick, while the 1-10-lb. marks are on a graduated strip at the back of the glass, an arrangement permitting easy reading.

To obviate the etching of the glass tube by the hypochlorite, clear water is run into the tube as soon as the storage tank is filled, or the gage cock may be closed during the filling operation so as to exclude the hypochlorite solution at all times. The difference in the reading due to the difference in the specific gravities of the water and the solution is too small to correct.

CONSTANT HEAD CONTROL

Instead of the usual orifice box a simple arrangement used by the company for some time in the feeding of coagulant solution at the Willard plant has been used with slight modifications for the hypochlorite of lime feed. The former coagulant rig consisted of a 30-in. vitrified sewer pipe set bell end down and filled in with about 10 in. of concrete to make a bottom.

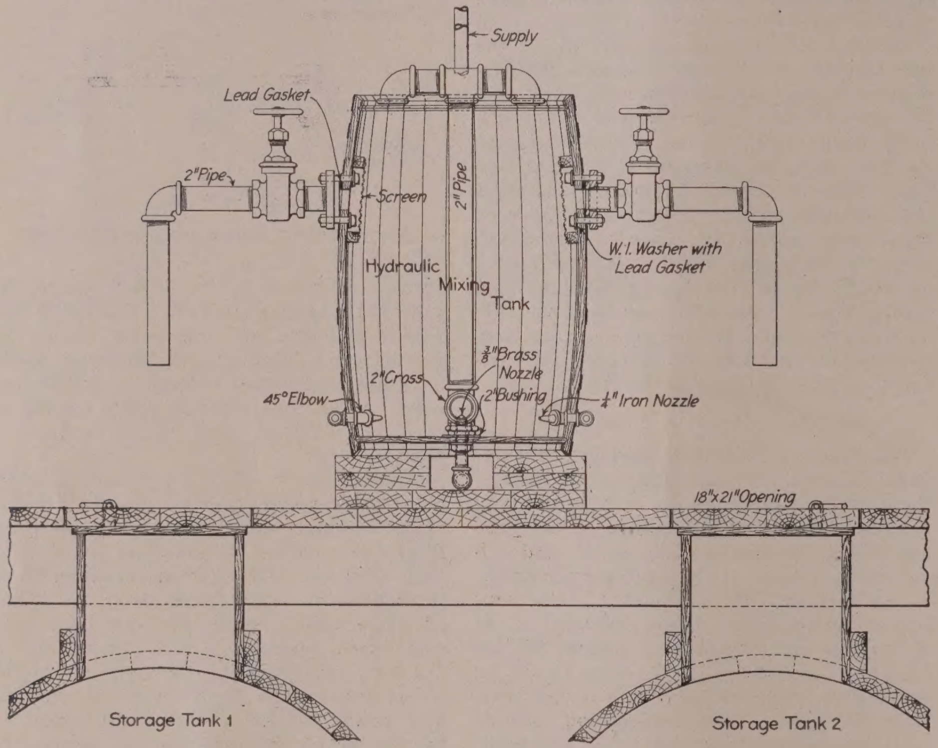
A constant head supply to this tank was furnished through an ordinary brass hopper ball cock. The outlet was through a plug cock with a lever handle extended by a wire pointer over a graduated board. The graduations were arbitrary, as the cock was eaten out in time and gave increased discharges for the same setting. This was of little consequence so long as the cock did not leak, for reliance was placed entirely on data obtained by reading the gage



SCALES ON SOLUTION TANKS ARE GRADUATED TO POUNDS OF SOLUTION on the solution tank for applying the correct amount of coagulant.

In the hypochlorite-of-lime plants the vitrified pipe was replaced by whiskey barrels. Ordinary ball cocks with paraffin or blocks of wood dipped in asphalt are used to keep a constant head and ¾-in. steam cocks with extended lever handles control the discharge. A fine adjustment screw with the fulcrum and nut set in tapered holes in a fixed quadrant and the lever respectively allow the operator to remove the screw, flush the valve and replace the lever at exactly the former position. The plug in the cock is filed away for ⅜ in. to give a fine stream.

The design and construction of these various devices were carried out under the direction of D. G. Thomas, chief engineer of the Denver Union Water Company.



DETAILS OF HYDRAULIC MIXING TANK AT DENVER HYPOCHLORITE PLANT

THE ADAPTABILITY OF REINFORCED CONCRETE for irregular sloping surfaces is well illustrated in an article in the "Engineer", London, describing the new Mappin Terraces at the Zoological Gardens. The structure consists of four artificial hills, and a number of sloping terraces which are very irregular, the hills being some 70 ft. high and covering an area of 39,000 sq. ft. The employment of reinforced concrete solved all the constructional difficulties and enabled the work to be carried out at a cost far below that entailed by any other method of construction. Most of the surface of the hills was formed by a shell 3 in. thick, and the lower terraces, where the heavier animals are quartered, have a thickness of from 5 to 7 in. Incidentally the designer makes the claim that coarse, naturally graded, uncrushed ballast has invariably been found to give better results as regards both strength and density than the ¾-in. crushed ballast and sand mixture usually specified. A number of large water tanks were formed in the surface of the terraces, and made of concrete containing only the coarse aggregate. They were found to be absolutely watertight without the use of any waterproofing materials whatever.

Railway Electrification—Possibilities and Precautions

W. S. Murray Tells Western Society of Engineers of New Opportunities for Economy Shown by Electric Operation of New Haven

"THERE is no question in my mind but that the greatest return to be secured by electrification will be through freight movements." This statement was made by W. S. Murray, consulting electrical engineer of the New York, New Haven & Hartford Railroad, in a paper written for the electrification night, March 16, of the Western Society of Engineers. Mr. Murray thinks that while the economy of electrification by virtue of lessened fuel consumption and decreased maintenance of electric engines has been appreciated in the past, there is now fast coming to the front a more visualized economy in the reduction of expenses by effective savings in train-miles. On the New Haven this is to be accomplished by the double-heading of freight trains operated between the Harlem River and New Haven, and in this connection Mr. Murray points out the automatic complement of increased track capacity.

WATTMETER STATISTICS

Mr. Murray states that while electric passenger service has been in effect since 1907 between Stamford and New York, recent experience with switching operations and freight movement on main-line tracks has been a revelation in the possibilities of heavy electrical traction. There are now wattmeters installed on all of the electric engines to register the kilowatt-hours of consumption, and from these "watt-hour constants" have been averaged—and they signify that an electrical ton-mile as against the steam ton-mile reduces the coal pile in the ratio of one to two. The watt-hour constants per 1000 ton-miles of trailing loads are as follows: Fast freight, 30; slow freight, 30; local freight, 85.

Two things Mr. Murray thinks most pertinent to the advance and successful utilization of electricity in the field of heavy traction. One of these is the mercury-arc rectifier; the other is effective electrical administration on the part of the railroad electrified.

With reference to the mercury-arc rectifier, there is in commercial operation on the New Haven a car taking power from the 11,000-volt alternating-current overhead-contact system and converting it into direct current for application to its propulsion motors. On the New Haven, Mr. Murray states that the present alternating-current motive power now in use, by the application of a rectifier, will be increased 25 per cent, and that transmission and motive-power facilities of the highest order of efficiency will be simultaneously obtained.

IMPORTANCE OF ELECTRIC ADMINISTRATION

With regard to administration he desires to impress the fact that the methods pursued in producing a ton-mile of any character on a steam basis must be abandoned when the drawbar pull comes from electricity. As he puts it, the error of holding a steam master mechanic responsible for an electric engine-mile of any character is equally patent as the error of holding a steam railroad shop man responsible for the maintenance and repairs of electric engines. As electric power houses and transmission lines require men of electrical talent, electro-mechanics inside and outside of the shop are essential to the success of proper maintenance and inspection of electric motive power. A successful operation result, after electrification has been applied, is entirely dependent on a clear understanding and observation of this real difference between steam and electrical operation.

Omaha Water Chemist Increases Efficiency of Alum

By Mixing Aluminum Sulphate and Scrap Iron a New Compound with High Coagulating Value Is Produced

A MATERIAL increase in the efficiency of aluminum sulphate as a coagulating medium has been effected by Andrew Jacobson, chemist of the Metropolitan Water District, Omaha. The new process depends on the reaction between a solution of ordinary filter aluminum sulphate and metallic iron in the form of scrap or borings. Mr. Jacobson states that while a mixture of the sulphates of aluminum and iron is not new, this process, so far as he has been able to learn, is new. A patent has not yet been issued, but practically all claims set forth have been allowed. A new and definite compound of basic aluminum sulphate and ferrous sulphate is formed according to the following reaction:

$$Al_2(SO_4)_3 + Fe + 2H_2O =$$
$$Al_2(OH)_2(SO_4)_2 + FeSO_4 + H_2$$

A large amount of data collected both from laboratory experiments and trials in practical operation on the Omaha water supply indicates consistent results when one-half the former amounts of chemical are used.

MOTOR TRUCKS TO COLLECT GARBAGE were put in service in Los Angeles March 1. The city has purchased seven 2½-ton trucks which will cover the entire city once a week. The city has been divided into seven districts, and a schedule for the trucks has been so arranged that each district will be covered on a specified day each week.

Central Hydroelectric Plant Replaces Separate Units at Cohoes—Part II

Modern Installation at This Point Marks a Great Improvement Over the Old System of Canals at Six Levels

By A. G. HILLBERG
Wegmann & Hillberg, Hydraulic Engineers, New York

[*In the first part of this article published last week, page 352, the conditions at Cohoes previous to the concentrated development of power were outlined, showing the complicated and inefficient arrangement of separate small water-power plants. The general arrangement of the new development was then set forth and the forebay, gate-house and head gates were described. The present article completes the description from that point.*—EDITOR.]

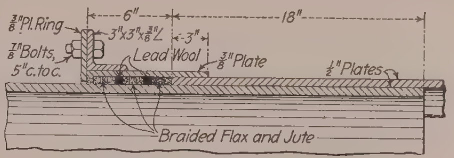
BACK of the gates have been placed the bellmouths of the penstocks. The drawing shows the way in which first the area by means of inclined walls has been reduced in length of 8 ft. from 18.5 x 15 ft. to an ellipse with 11 and 16 ft. axes and then further in an additional length of 6 ft., to a circle of 11 ft. diameter. The maximum velocity of the water between the gate piers is 2.6 ft. per second, at the beginning of the bellmouth 4.15 ft., at the beginning of the elliptical part 7.67 ft. and in the penstock 12 ft. per second.

A low point has been made in the bellmouth about 5 ft. back of the face of the masonry and connected to a 12-in. drain governed by a gate valve in each bay. The stems of these valves have been extended to the top of the masonry.

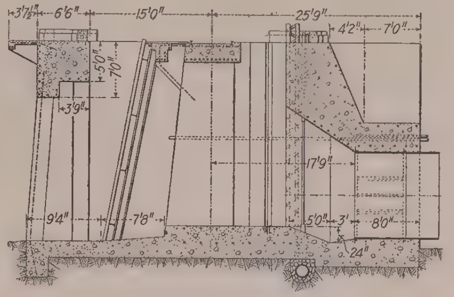
The penstock proper is 11 ft. in diameter, and as soon as it has left the gate-house it curves at a radius of 30 ft. and descends the cliff to the power house. The center of the penstock at the gate-house is at El. 141 and at the power house it is at El. 69. The curve at the power house also has a radius of 30 ft.

No air vents have been provided at the top as the location of the head gate, its unsealed top, the sharp inclination of the roof of the bellmouth and the method of opening the gate permit an easy escape of the air. The space back of the gate, when closed, allows air to enter should the penstock be emptied of its contents. Under normal operating conditions each penstock will carry 1150 sec.-ft. The hydrostatic pressure used for determining the thickness of the plates was increased 50 per cent to allow for water hammer. The horizontal portion at El. 141 and the upper elbow have been made of ⅜-in. plates, the next 14 ft. of ½-in. plate, the rest of the tangent of 7/16-in. plate and the lower elbow and the straight portion at El. 69 of ½-in. plates.

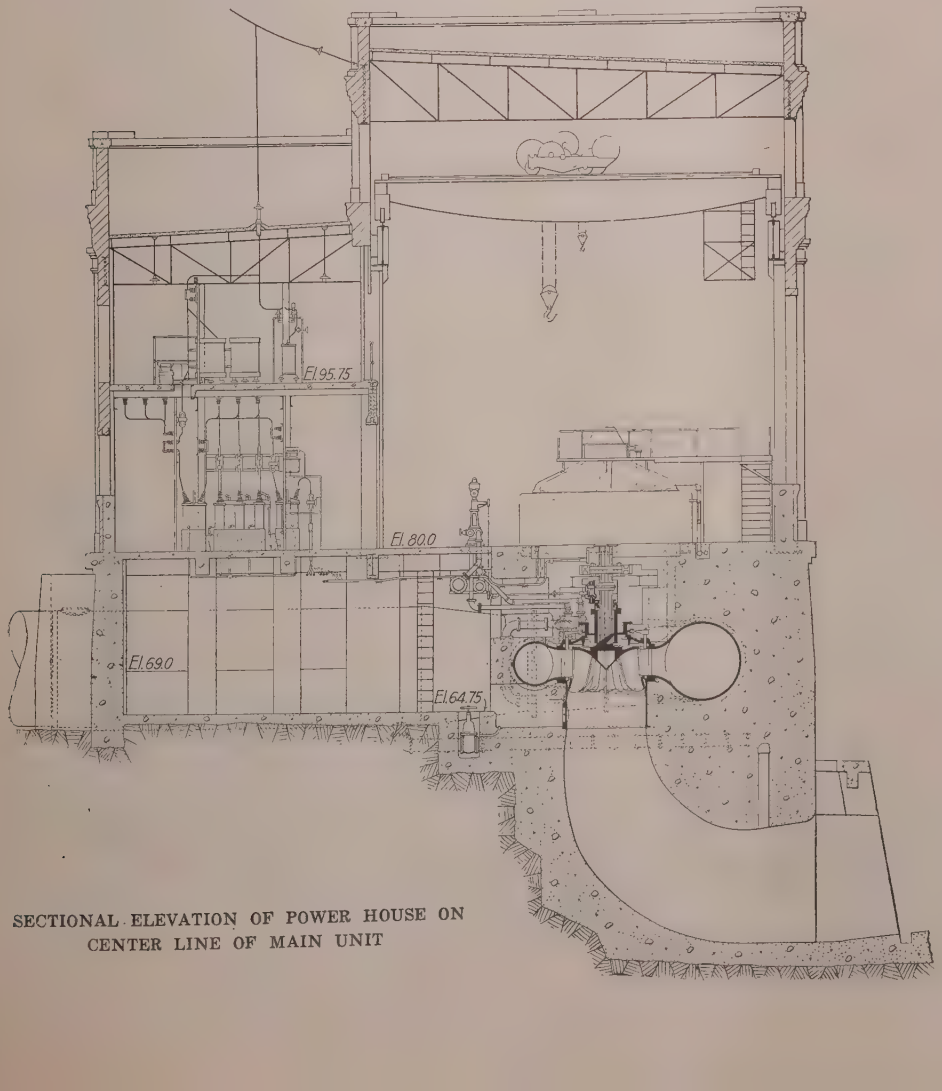
As the bays in the gate house are 25 ft. and those in the power house 33 ft., it was necessary to spread the penstocks. Penstock 3, consequently, is located in a vertical plane, penstock 2 is located in a plane making an angle of 6 deg. 20 min. 20 sec. with the vertical, and the angle with the vertical of the plane of penstock 1 is 12 deg. 31 min. 40 sec. The future penstocks 4 and 5 have been located in a similar way.



DETAIL OF PENSTOCK JOINT



SECTION THROUGH GATE-HOUSE SUBSTRUCTURE



SECTIONAL ELEVATION OF POWER HOUSE ON CENTER LINE OF MAIN UNIT

The upper elbow has been anchored by four 1¾-in. rods, embedded in the concrete saddle and extended into the rock and grouted. They hold the penstock by two 6 x 4 x ½-in. angles encircling the pipe. Below the upper elbow is provided an expansion joint shown in the drawing. The first girt seams, above and below, are double-riveted butt joints and the longitudinal seams in both the inner and outer plates are double-riveted butt joints with countersunk rivets where necessary. All other joints, longitudinal as well as transverse, are lapped and double riveted. Stiffening rings of 6 x 4 x ½ in. angle bars have been riveted to the pipe at intervals of about 11 ft.

At the top of the penstock immediately outside of the gate-house, as well as at the bottom outside of the power house, 24-in. manholes have been placed. Inside the power house near the wheel casing a 12-in. drain has been provided.

Such portions only of penstocks 4 and 5 as are embedded in masonry or required for making connections in the future have been installed.

At the back of the gate-house at El. 150 is a driveway of reinforced concrete 12 ft. wide supported by structural steel framework on the upper saddles of the penstocks. This driveway was provided for access to the power house by the road now descending the cliff.

POWER HOUSE

The power house is approximately 170 ft. long and 68 ft. wide. As will be seen from the cross-section the generator floor is located at El. 80. The switchboard gallery floor and the 2300-volt switch room are located at El. 93, while the floor containing the 12,000-volt feeder reactances and lightning arresters is at El. 95.33. A latticed girder covered with concrete has been placed between the columns of the generator room for bracing. This girder serves as a balustrade for the low-tension switch gallery and hides the difference in elevation between the floors of the balcony. The floor of the basement is at El. 65 and it has a 3-in. pitch for drainage.

As stated above, the spacing of the units is 33 ft. This distance was too long for the bays of the structural steelwork of the superstructure, which, therefore, was designed with 16.5-ft. bays. The superstructure, accordingly, has ten bays. The walls are made of brick, embedding the steel columns, and the roof is a reinforced concrete slab supported on steel purlins and trusses.

An interesting feature of the building is that the roof of the switch house is lower than that of the generator room. This has been acomplished by an original and compact layout of the electrical part of the installation. On the side of the power house facing the cliff a tower 10 x 20 ft. in plan has been erected. This tower is divided into two shafts, one for an elevator of 4000 lb. capacity and the other for a steel stairway. In the center of this stairway is a 2 x 3-ft. flue used for the ventilation of the basement, where the resistance grids of the main generator field rheostats have been located. At El. 150 the tower is connected with the driveway back of the gate-house by a steel bridge.

For erecting the machinery a 50-ton electric, overhead traveling crane has been installed. It is built by the Whiting Foundry & Machinery Company.

GENERATING UNITS

Three units, each of 10,000 hp capacity, complete the first installation and provision has been made for two more. The generators are 9000 kva, 3-phase, 40-cycle, 12,000-volt with a speed of 185 r.p.m. They have been designed with a margin of field excitation sufficient to give the full output at any voltage between 11,500 and 12,700 at 80 per cent power factor. They are ventilated by means of air admitted through areaways placed on top of the penstocks through the substructure. The thrust bearing, which is of the Kingsbury type and designed for a static load of 160,000 lb., is located on top of the generator and supported on a heavy spider of six arms. In this support is placed the upper steady bearing for the 16-in. shaft.

The center line of each single-runner turbine is at El. 69. A reducer 11 ft. long connects the penstock with the cast-iron scroll case. The diameter of the end of the scroll is 8½ ft. so that the reducer accelerates the velocity of the water from 12 to 20 ft. per second. The unit is designed to operate at a speed of 185 r.p.m. under a head varying from about 85 ft. during periods of flood to about 98 ft. during times of extreme low water.

Leakage collecting on top of the runner is siphoned by a set of three 6-in. pipes connected to a 9-in. header on a 9-in. pipe running around the scroll case and entering the draft tube below the runner.

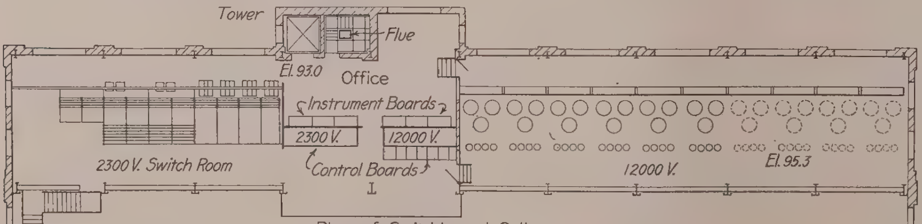
The shaft is made in two pieces coupled together with a heavy flange coupling below the generator rotor. The periphery of this coupling has been given a smooth finish and on it has been placed a powerful hand operated band-brake capable of stopping the revolving element within 5 min. This brake consists of a flexible steel band provided with oak blocks. It is supported at El. 77 on a frame of 12-in. beams.

On the shaft below the frame is fastened the gearing for driving the shafting controlling the governor fly-balls. The design of this gearing is somewhat novel in that the usual bevel gearing has been replaced by a set of straight gears driving a short countershaft. This shaft in turn is provided with a set of small bevel gears. The advantages of this arrangement are obvious.

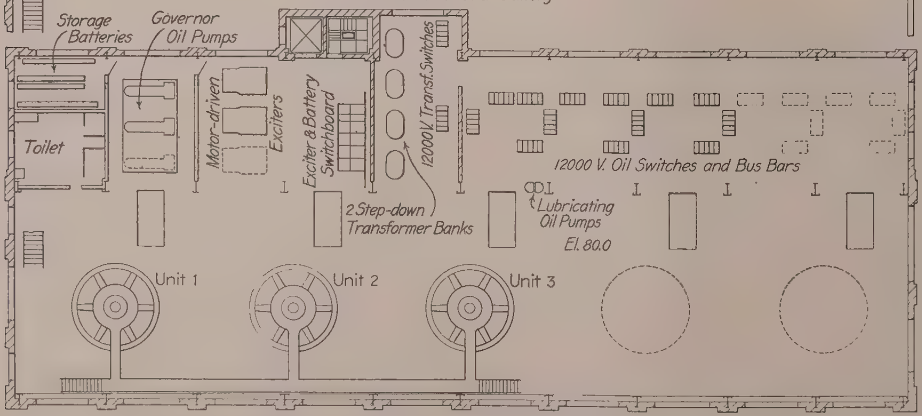
On the crownplate of the turbine and built integral with it is the lower steady bearing. It is 40 in. long and lined with lignum vitæ strips. It is lubricated by water carried in a 3-in. pipe from the gate-house. On its outside is the gate-operating ring moved by two servo-motors of 60,000 ft.-lb. capacity.

EXCITERS

As will be seen from the accompanying drawings no waterwheel-driven exciters have been installed. The first plans considered individual exciters placed on top of the generators, but, as energy will be available both from the small hydroelectric station at the Champlain Canal and the steam station at Harmony Mills, it was found more advantageous to install separate motor-driven exciter sets. These have been placed at El. 80 in bay 3 and consist of 165-kw, 250-volt, direct current generators driven by 250-hp, 2300-volt, 2-phase, 800 r.p.m. induction motors. Two of these sets are now being installed and space has been provided for an additional set of the same capacity.

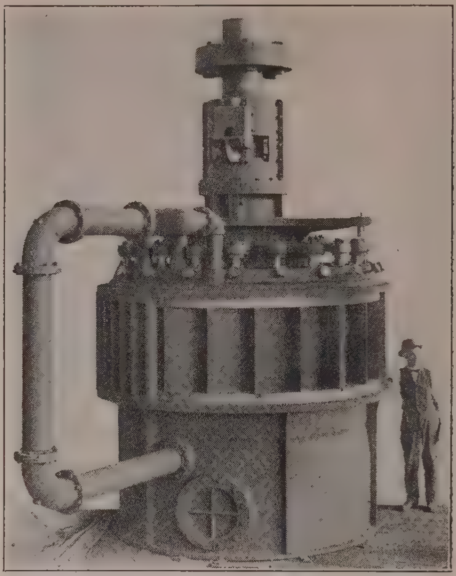


Plan of Switchboard Gallery


Storage Batteries
Governor Oil Pumps
Toilet
Motor-driven
Exciters
Exciter & Battery Switchboard
12000 V. Transf. Switches
12000 V. Oil Switches and Bus Bars
2 Step-down Transformer Banks
Lubricating Oil Pumps
El. 80.0
Unit 1
Unit 2
Unit 3

Plan of Switch House and Generator Room

ARRANGEMENT OF HYDRAULIC AND ELECTRIC EQUIPMENT PLANNED FOR EFFICIENCY



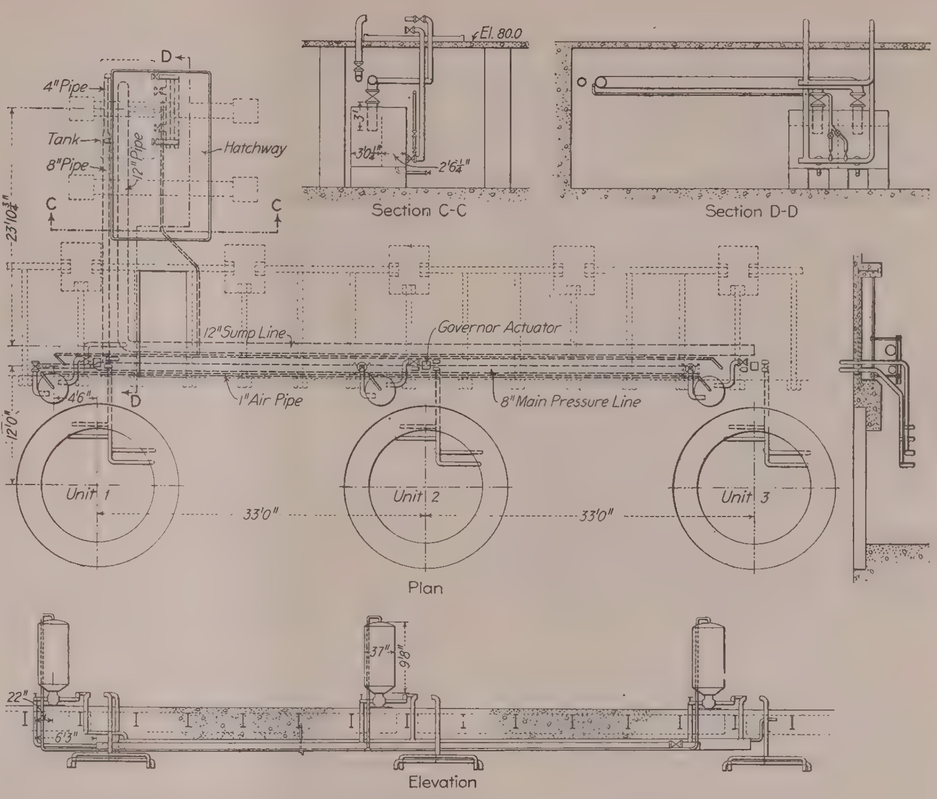
SINGLE-RUNNER TURBINE DEVELOPING 10,000 HP

GOVERNOR SYSTEM

In designing the governor system the advantages of centralization of the auxiliary equipment was appreciated. As bays 1, 3, 5, 7 and 9 of the basement are occupied by the penstocks and the generator areaways, bay 2 was chosen for the oil pumping plant. No pumps have been located at the units. The quantity of oil under pressure required to operate the servo-motors is drawn from tanks, one for each unit. These tanks are 37 in. in diameter and 9 ft. 8 in. high, located at El. 80 and placed between the high-pressure supply main and the governor relay valve controlling the operation of the servo-motors. As a governor, when called upon to act, requires a certain quantity of oil immediately and as a pressure loss at one point of the governor system will start the other governors, it was necessary to devise means whereby such pressure losses could be prevented. The upper parts of the tanks, therefore, are filled with air under pressure, and connected to a compressor. The system is so designed that the oil pumps run all the time, while the compressor is run only when required. The pressure is 200 lb. per square inch.

The induction motor-driven, triplex pumps, of which one is a spare, of 100 gal. per minute capacity and running at 45 r.p.m., have been installed at El. 80 above the oil tank in the basement. Space has been provided for one more to be installed at the same time as the additional units. The pump motors are rated 25 hp, run at 760 r.p.m., and are designed for 2-phase and 220 volts. The air is furnished by a Gardener-Rix 6x6-in. geared compressor. It is water cooled, driven by a 10 hp, 2-phase, 250 volt, induction motor and delivers 10 cu. ft. of free air per minute.

In the basement below the pumps is placed the oil tank. When the oil enters the tank it is first led into a compartment from which it passes through a vertical screen into an adjacent compartment. This screen is made of three thicknesses of brass wire



PLAN, ELEVATION AND SECTION OF GOVERNOR OIL PRESSURE SYSTEM

netting of which the two outer have 50 meshes per inch and the middle, which serves as the support, has 2 meshes per inch. This screen can be lifted out for cleaning.

Each governor actuator, which is complete with its primary and relay valves, speed balls, motor control and anti-racing mechanism, controls each pair of servo-motors. The anti-racing device has been equipped with a special vertical dash-pot developed for this installation; it is an improvement over the old-style horizontal dash-pot.

In connection with the relay valve mechanism a unique hand pumping device has been used as shown in the photograph. In case the main oil pressure pumps are not in commission, and there is no pressure in the main system, which would be the case in starting up the plant, the operator may, by the use of these hand pumps, bring the gates to any desired position and hold them at that point. The principal valve in this device is enclosed in a special case to prevent its being tampered with. The rules for operating the valve have been cast on the inside of the cover of the case, so that the operator does not have to rely on his memory.

GRAVITY OILING SYSTEM

All bearings, including the thrust bearings on top of the generators, are supplied with oil by gravity. This oil is fed from two tanks placed between the roof trusses of the generator room. These tanks are 3 ft. in diameter and 12 ft. long, and are placed in a horizontal position. Two 3-in. pipes, one for each tank, enter on the upper side, carry the oil from the pumps and keep the tanks full. A 3-in. overflow connects both tanks and is carried back to the tank in the basement. To this pipe is connected 2-in. drains from the bottom of the tank. The 4-in. clean oil supply to the system consists of 4-in. pipes, one from each tank, Y-connected at El. 80 to the gravity oil feeder. All of these pipes have been carried up to the tanks at column 18.

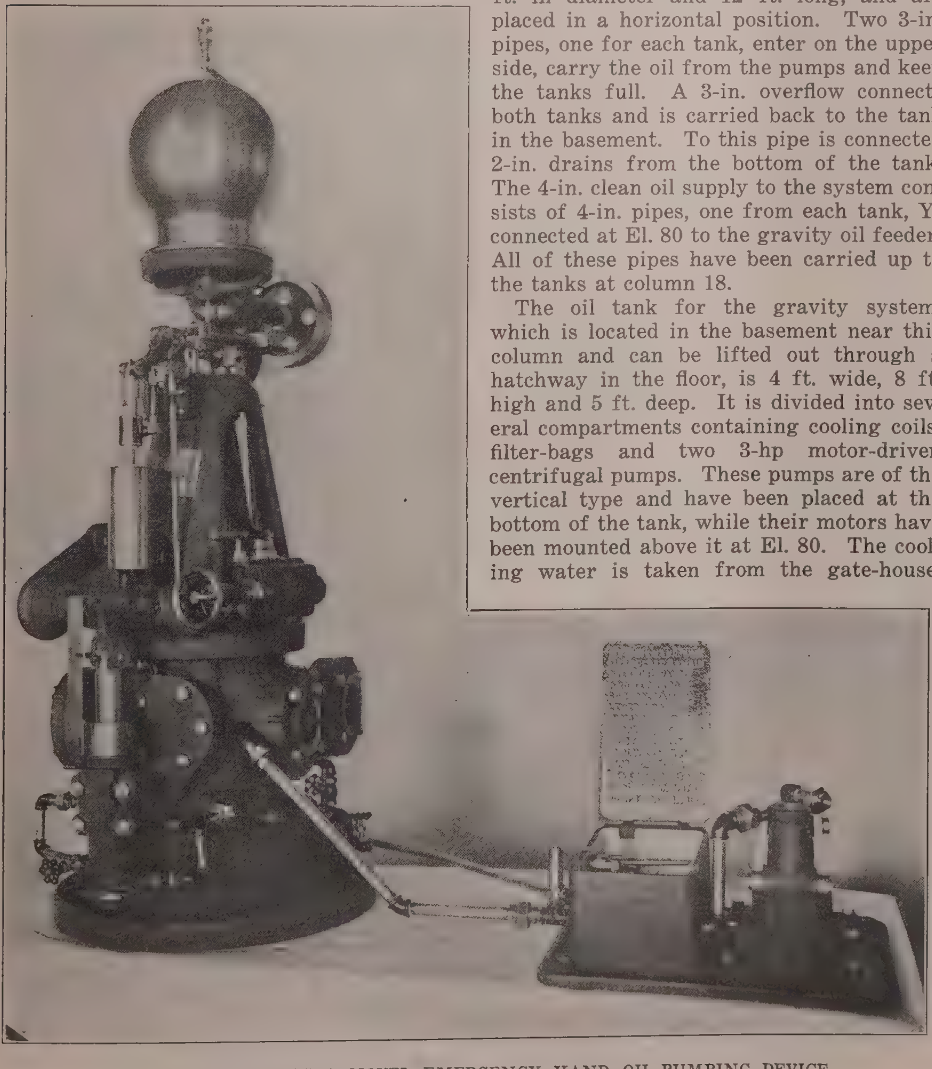
The oil tank for the gravity system, which is located in the basement near this column and can be lifted out through a hatchway in the floor, is 4 ft. wide, 8 ft. high and 5 ft. deep. It is divided into several compartments containing cooling coils, filter-bags and two 3-hp motor-driven centrifugal pumps. These pumps are of the vertical type and have been placed at the bottom of the tank, while their motors have been mounted above it at El. 80. The cooling water is taken from the gate-house.

The top sections of the draft tube are circular, until a diameter of 10 ft. is reached. Then tangents have been inserted making approximately elliptical areas as shown in the drawing on page 398. The end area is 250 sq. ft. The rate of velocity change is such that the corresponding change in velocity head will always be less than the increase in static head due to the fall through the draft tube. The theory is that in order to force the discharge to slow up, expand and fill the cross-section, there must be a back pressure or back pressure head, caused by the difference in elevation, equal to the change in velocity head. If this condition is secured for maximum discharge, it will, naturally, also hold for all smaller discharges. The water leaves the end of the cast-iron part of the draft tube below the runner with a velocity of 25 ft. per second and is reduced to 4.4 ft. The changes in velocity and corresponding velocity head are shown on the diagram in the upper left-hand corner of the following page.

The center line of the unit is offset 21 in. from the center line of the bay and the draft tube is symmetrical around the former, except the six last sections. These have been offset in a downstream direction on a straight line extending from the center of section 21 to a point 7½ in. downstream from the center line of the unit in the plane of section 27.

TAILRACE

Because of the two canals diverting the waters of the Mohawk River, practically no water goes over the falls during low water periods. The low water channel below the falls, therefore, is a narrow winding brook, which, of course, provided insufficient facilities for carrying away the tail water from the station. The company had to enlarge this channel and remove about 20,000 cu. yd. for a tailrace between this channel and the power station. By doing this the head is estimated as being increased about 4 ft.



EACH GOVERNOR HAS A NOVEL EMERGENCY HAND OIL-PUMPING DEVICE

Note the rules of operation cast on the cover so that the operator will not rely on his memory.

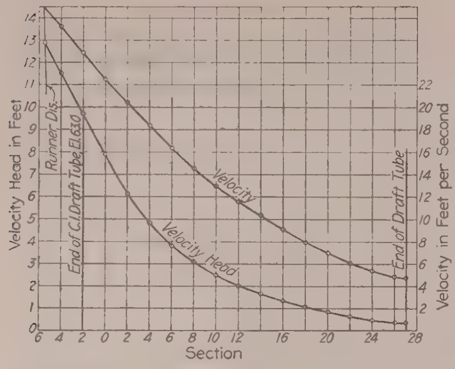


DIAGRAM OF OPERATION OF DRAFT TUBE

Naturally, the water level in the tailrace during periods of low water depends upon the number of units in operation, as the tailrace channel had to be so designed, that the draft tubes are sealed even if only one unit is operating at partial load. With one unit in operation the level will be at El. 58, while if all three turbines are running, the level will be at El. 60.

In times of mean and high water the river will reach the power house and should the record flood of 1913 be repeated, the water surface will reach El. 74. The generator room floor has been placed at El. 80, thus giving a 6 ft. margin.

SWITCH HOUSE

The amount of space permitted for this article does not allow an extensive treatment of the electrical part of the installation. The grouping of the machinery and the location of the switchboards are shown in the accompanying plans, and cross-section. One point of special interest to the civil engineer, however, is that the various apparatus have been placed so as to leave the walls free and permit as large window areas as possible. This has been accomplished by placing the equipment along the longitudinal center line of the switch house and mounting the busses and feeders on pipe railing standards.

PERSONNEL

The consulting engineer for this development is Thomas E. Murray and the designing and supervising engineers are Sanderson & Porter, of New York City. The Cohoes Company, of which L. Semple is president and W. P. Parsons, manager, has built the station by force account and A. C. Polk served as resident engineer. The Platt Iron Works, of Dayton, Ohio, delivered the turbines and the governor oil-circulating system; the Troy Boiler Works, the penstocks; and the General Electric Company all the electrical parts of the installation. The governor actuators have been built by the Lombard Governor Company and the lubricating oil system was designed and delivered by the Peterson Engineering Company of Milwaukee, Wis.

The author begs to express his thanks for the co-operation received from the engineers of Sanderson & Porter in preparing this article.

Specification for a Creosote-Coal Tar Solution

Committee on Wood Preservation of Railway Engineering Association Offers Rules to Minimize Danger in Diluting Creosote

WITHOUT receding from the stand taken a year ago, that the dilution of creosote with coal tar is not to be encouraged, the committee on wood preservation of the American Railway Engineering Association, presented at the convention last week a specification for the mixture. This was done to safeguard as far as possible a practice which the committee realizes is widespread and is likely to continue on account of the scarcity of creosote. The specification, which the committee admits is not strictly accurate in a technical sense, but believes meets all practical requirements, is as follows:

The oil shall be a pure coal-tar product, consisting only of coal-tar distillates and oils obtained by the filtration of coal tar. It shall contain no admixture of crude tar.

Water shall not exceed 2 per cent.

Specific gravity at 38 deg. C. shall not be less than 1.03, nor more than 1.10.

Matter insoluble on hot extraction with benzol shall not exceed 2 per cent.

The specific viscosity (Engler) at 82.3 deg. C. (180 deg. Fahr.) shall be not more than 1.170 for 200 cu. cm. No variation above this standard shall be allowed. The term "specific viscosity" in this case shall mean the number of seconds found for the sample tested, divided by the number of seconds for water at 20 deg. C., given in the official certificate for the viscosimeter used.

On distillation by the standard method of the American Railway Engineering Association, it shall yield the following fractions based on dry oil: Not more than 1 per cent at 170 deg. C.; not more than 5 per cent at 210 deg. C.; not more than 30 per cent at 235 deg. C.

The residue at 355 deg. C. shall not exceed 26 per cent.

QUALITY OF THE COAL TAR

The committee considers the quality of the coal tar used to be an important factor, and as a further protection to the consumer recommends the following:

1. That the refined coal tar used be subject to inspection or analysis by the railway company at any time, such examination to be permitted upon request prior to the mixing of the solution—this is for the reason that determination of the quality of the coal tar after its addition to the creosote is difficult, if not impossible.

2. That in case the railway company makes its own solution of coal tar and creosote, using crude tar for this purpose, it specify clearly as to the quality of the tar.

PRECAUTIONS

In last year's report the committee submitted six precautions to be followed in the use of coal tar in solution with the creosote. These the committee modifies in certain particulars, so that they now read as follows:

1. That there be a distinct understanding between all concerned that a mixture is specified and used.

2. That the coal tar may be added to the creosote at treating plants when suitable facilities for properly mixing the solution are available; otherwise the solution be mixed by the manufacturer, but subject to the inspection or supervision of the railway company.

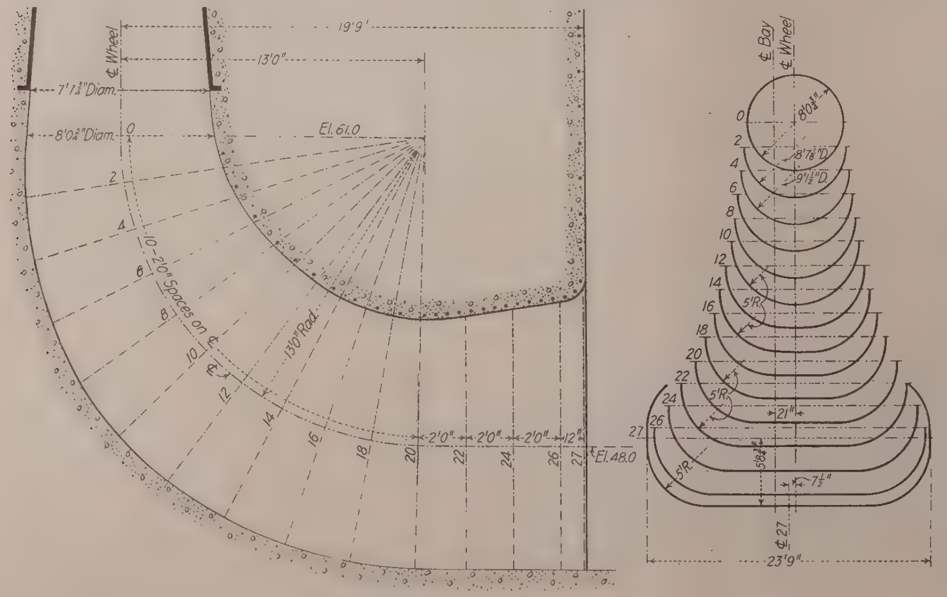
3. That under no circumstances should the coal tar added constitute more than 25 per cent of the mixture.

4. That the coal tar and creosote be thoroughly mixed at a temperature of approximately 180 deg. Fahr. before being applied to the timber, and that the mixing be done in tanks other than the regular working tanks, and that the tanks containing the mixture shall be heated and agitated thoroughly each time before any oil is transferred to the working tanks.

5. That only low-carbon coal tar be used, the amount of free carbon not to exceed 5 per cent.

6. That in treating with the mixture the temperature of the solution in the cylinder be not less than 180 deg. Fahr.

A CEMENT FACTORY AT KATNI, INDIA, is almost completed and will soon begin to manufacture Portland cement. The plant is the property of the Katni Cement & Industrial Company, Ltd., and is expected to turn out from 30,000 to 35,000 tons of cement per year. This will be manufactured by the wet process in rotary kilns driven by electric power. In addition to the cement works the same company has erected works for the manufacture of roofing, ridge and ceiling tiles, glazed wall and flooring tiles, fire bricks, glazed drainage pipes, glazed earthenware troughs for carrying electric cables, acid proof jars and a number of hospital necessities.



Sectional Elevation

Cross-Sections

DRAFT TUBE IS CIRCULAR AT TOP AND ELLIPTICAL AT LOWER END

Record Set for Weight of Steel Erected in One Day

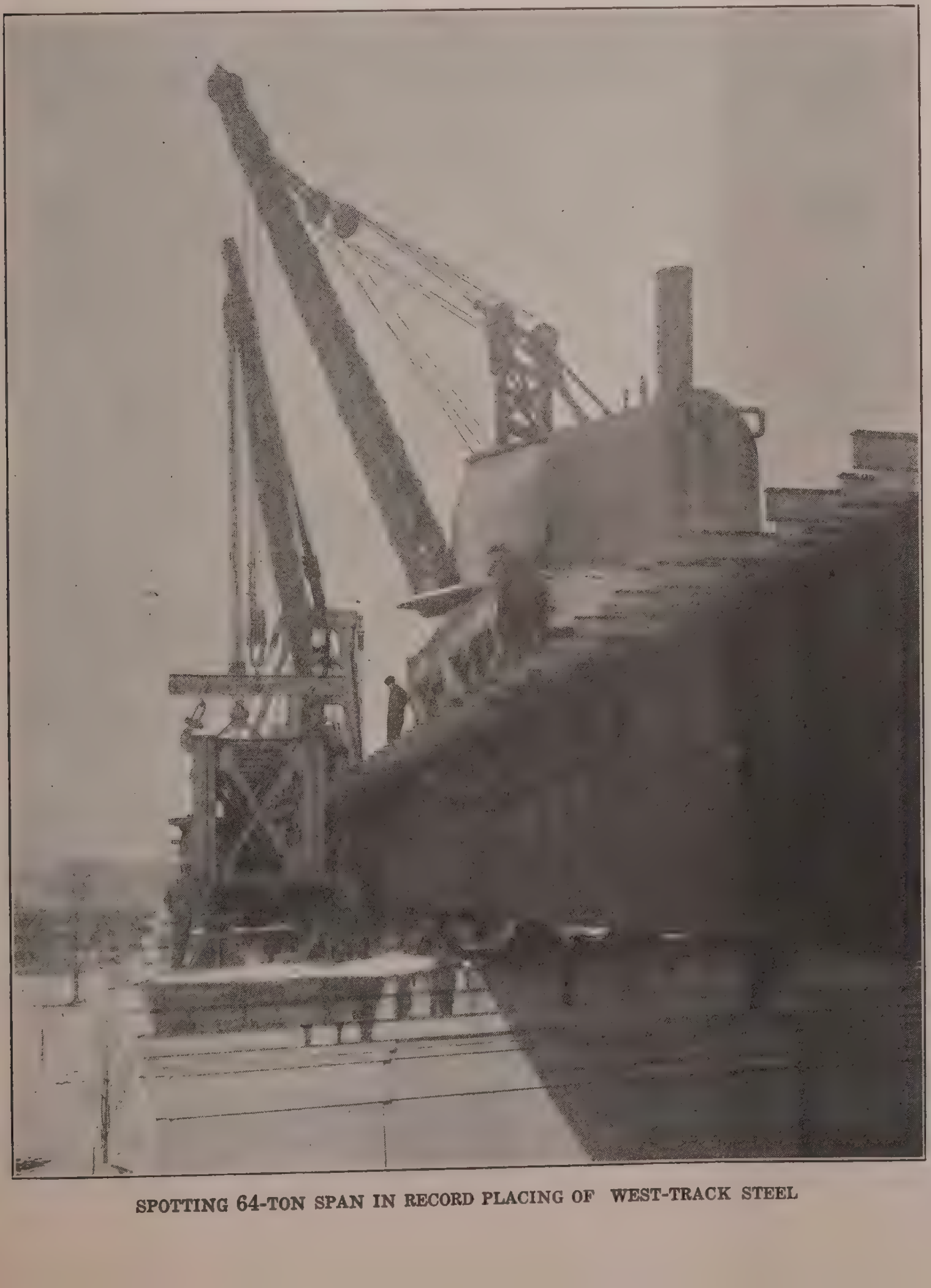
Fifteen Hundred and Four Tons of Steel Placed in Eight Hours at Randall's Island on Hell Gate Bridge Approach, New York Connecting Railroad

A REMARKABLE record of 1504 tons of steel placed in one 8-hr. day was made March 8 by the McClintic-Marshall Company in erecting the steel-girder spans for the west track of the north approach to the Hell Gate arch of the New York Connecting Railroad's East River bridge. (See Engineering Record for July 19, Sept. 20 and Dec. 27, 1913, pages 79, 328 and 729 respectively for general and detailed description of this work). Twenty-two deck-plate girder spans, eighteen 80 ft. and four 87 ft. long, made up 1476 tons of this total, and these spans were all set in 6½ working hours. The remainder of the steel placed consisted of I-beams, which will later be concreted in to form the bridge floor.

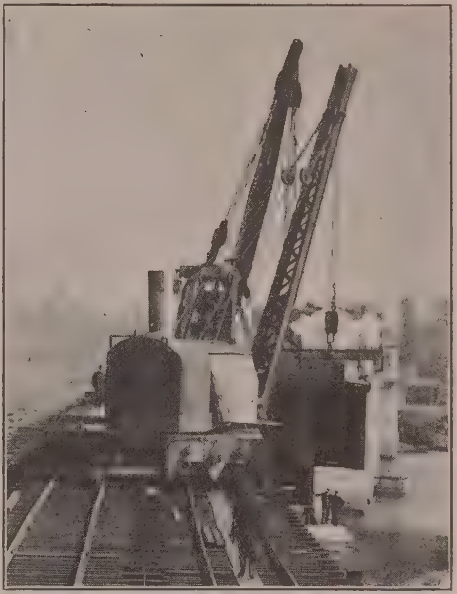
This record would have been duplicated or broken in setting the steel for the east track on March 10 but for one of those accidents which the most careful supervision will not always guard against. In setting the twenty-second span a strand in the boomfall cable of the derrick car parted, doing no serious damage, but stopping work for the day. The weight of the spans set before this accident, however, totals 1406 tons.

LAYOUT OF WORK

This speed of erection was due to favorable layout. The Connecting Railroad rises, south bound, from tracks 1, 2, 5 and 6 of the Westchester Branch of the New Haven road, and turns east. Tracks 5 and 6 cross the New Haven tracks east of them and join tracks 1 and 2 of the Connecting Railroad in a solid four-track structure. From this point twelve deck plate girder spans and two bascule spans over Bronx Kill carry the roadway to Randall's Island. Across Randall's Island to Little Hell Gate the viaduct consists of twenty-three deck spans. The girders for the two center tracks across Randall's Island were erected first, beginning from the north end, one girder placed at a time, and the diagonals riveted in the field. Having completed the center tracks, it was possible to run a string of cars loaded with steel on one track, run cranes on the other, and set the whole line of girders for each outside track in one operation.



SPOTTING 64-TON SPAN IN RECORD PLACING OF WEST-TRACK STEEL



CARS CUT AT CRANE TO SET EACH SPAN

Extra long outriggers under crane blocked second track when set

For this purpose, the outside girders, with their X-bracing, were riveted up into complete spans at the shop. Only the south pair of girders on each side-track were delivered knocked down. These spans are the south end of construction at present, as the erection of the four 300-ft. deck truss spans across Little Hell Gate is just being started. Therefore, these last girder spans had to be set by the derrick-car working alone. They are 91 ft. long, and a complete span weighs too much to risk setting it as a unit with one derrick-car.

ERECTION EQUIPMENT

The derrick-car, built in the contractor's shop and especially strengthened for this work, was helped by a 50-ton Bay City locomotive crane. A 70-ton switch engine belonging to the contractor handled the trains of girders. The A-frame of the derrick-car is furnished with steel stifflegs, which can be swung in against the car. Consequently this car followed the erection from the north end, where the outside leg could be blocked on the last outside span set. In addition to this leg, a set of falls was hung on the opposite side of the A-frame and fastened by a long, heavy, hooked bar to the bottom flange of the inside girder under the car. These falls were tightened on a winch-head of the main hoist. For picking girders off the cars, the usual I-beam outriggers carried underneath the derrick-car were blocked from the inside end of the steel ties of the track on which the derrick car sat. In this way the derrick-car, when ready for action, cleared the train on the opposite track at all points.

The crane was not so easy to rig. Extra long I-beams had to be substituted for its usual outriggers, so they could be both blocked from and clamped to the upper flange of the inside girder on the opposite center track. The clamps consisted of a U-bolt and a pair of dogs for each outrigger. Thus, in lifting the girders, the outriggers bore down on the blocking, and in setting the girders, the outriggers were held down by the clamps. This rigging blocked the track on which the train of girders was handled, and for this reason the train had to be cut each time at the crane. Consequently the locomotive had to be on the north end of the string, in order to spot the cars carrying each span after the derrick-car and crane had been set. The cast shoes for the girders were set and grouted some time before erection commenced.

EACH MOVE PLANNED IN ADVANCE

Booming with such heavy loads—even the 80-ft. girder spans weighed 64 tons each—was slow and dangerous. To avoid it, the booms were set and dogged so that the girders, when swung to place, would hang over their shoes. A center line for the pair of wheels next the boom on each car was painted on the rail for each position of each crane for setting every girder. In this way the crane and derrick-car were exactly spotted, and only in one or two cases was booming necessary to center a span over its shoes. A balance-beam with dogs was used on each rig for picking up the spans. Each span was raised, swung to the derrick-cars till it cleared the flat cars, and lowered till it cleared the booms, which left the bottom of the span about 18 in. above the base of rail. The span could then be swung to place and lowered. As the two load-falls were vertical in lifting and placing the spans, it is evident that in swinging a span between the crane each loadfall had to drift back toward its own car. In other words, the ends of the two booms were closer together when in this position than the two hitches on the span. The dogs were prevented from slipping at this point, however, by the rivet heads on the under side of the top flanges of the girders.

SWITCHING OPERATIONS

Each girder-span was, of course, loaded on two flat cars. Naturally, an entire train load of twenty-two spans would not go on the bridge at once, as the total distance lost between the ends of the spans as loaded in the train was considerable. The whole twenty-two spans were delivered to the yard in each case the day before erection, and some thirty cars set out on the bridge for the next morning's work. At noon, while the crews were eating dinner, a switch was made and the remaining cars run out into place.

In starting off, the derrick-car and the crane were spotted for the first lift. The switch engine, meanwhile, cut off two cars, carrying the first span, and spotted them as soon as the crane and derrick-car were blocked. This span was set, and the crane's outriggers taken in. The switch crew then coupled up the empties with the cars carrying the next span, while the derrick-car and crane moved up. The cars carrying the second span were then cut from the string and spotted as before. The average time of the crane crews between picking one span and being blocked to pick the next was 15 min. An additional 2½ min. was lost each time in spotting the flat cars so each span could be hooked at exactly the proper point. After several spans had been set, the switch crew had to pull back and drop the empties, as there was too much slack in the car couplings for accurate spotting.

The construction of the New York Connecting Railroad is under the direction of Gustav Lindenthal, chief engineer. E. A. Gibbs is manager of erection for the McClintic-Marshall Company, and A. Toohey and G. D. Auchter are superintendent and engineer on the construction work. H. Meadows had charge of the derrick-car, and J. H. Shive of the crane on both of the days referred to.

SWITCH CARS IN SETTING EAST-TRACK SPANS ACROSS RANDALL'S ISLAND

Prevention of Dry Rot in Mill Buildings

Examination for the Presence of Fungus—Characteristics of Growth, and Effects of Variations in Humidity

THE importance of careful inspection of mill buildings with timber frames for dry rot is sometimes overlooked, and not infrequently with serious consequences. This inspection can be increased in effectiveness if the manner of growth and the conditions affecting the spread of the fungus be well understood. Much information on the subject is given in the pamphlet entitled, "Dry Rot in Timber," prepared by F. J. Hoxie, engineer and special inspector for the Associated Factory Mutual Fire Insurance Companies, most of the summary of which was given in this journal March 13, page 336. A more complete abstract is here given of the important facts regarding examination of buildings, growth and spread of the fungus, effects of varying degrees of humidity, and methods of dry-rot prevention.

EXAMINING AN INFECTED MILL

In examining a mill affected with dry rot, it is especially desirable to determine how far the rot has extended, whether it is still alive and whether it is of a variety which goes into a resting state and may therefore be revived at any time when the conditions of moisture become favorable; also, whether it is of a variety which may be destroyed by moderate heating or drying.

The extent of the rotting can generally be estimated approximately by boring test holes into the beams at frequent intervals. Sometimes where the rot has not progressed so far as to entirely destroy the structure of the wood, the chips are browner than the sound wood and more brittle. Hammering on the timber with the round end of a machinist's hammer is also sometimes useful where the wood is in an advanced state of decay.

To determine whether the rot is still alive is frequently a more complicated matter. The only positive test is to cut a large number of blocks about 2½ in. square from the wood at the point where the rot just ceases to be apparent, so that a part of each block is brown and a part has the appearance of sound wood. These should be placed in fruit jars and soaked in water containing 2 per cent of citric or tartaric acid for about six hours. Then the water should be poured off and the jars covered and left at a temperature of about 75 deg. Fahr. for two or three weeks. If long thread-like growths appear on any specimens, the fungus is doubtless alive.

PROGRESS OF DRY ROT AND EFFECT OF HUMIDITY

Investigation shows that in most cases rotting has taken place rapidly instead of gradually, as is usually assumed. In one case beams in the basement of a weaving mill rotted in two years, in another case the entire frame of a factory in Canada was replaced after three years, and in a third case nineteen floorbeams in a Connecticut mill had to be removed in two years.

Dry rot progresses much faster in summer than in winter in an ordinary building which is heated, and thus has its air made relatively dry during the winter months. Moist air gives the condition most favorable for rapid rotting. If there be a source of moisture in the building, such as moist pavements, leaky steam or water pipes, water from drying cloth, paper or moist cotton, or from artificial humidifiers, the air will there have high relative humidity.

In studying the effect of moisture on dry rot one must carefully distingush between relative and absolute humidity. Relative humidity is simply the ratio of complete saturation or the percentage of saturation of the air at the given temperature, while absolute humidity is the actual quantity of water in the air, regardless of temperature. In other words, the relative humidity at any temperature is the percentage which the humidity found bears to that required for saturation. For example, if air at 70 deg. Fahr. was found to contain 4 grains per cubic foot, the relative humidity would be 50 per cent, since 8 grains are required for saturation at this temperature. Looked at in another way, if external air in December, having an absolute humidity of

2 grains of water per cubic foot at a temperature of 30 deg. Fahr., is taken into a room heated to 60 deg., its relative humidity becomes decreased to 35 per cent, although its absolute humidity remains almost unchanged.

DRY ROT AND DAMP ROT

Most rot in mill timbers is caused by two groups of fungus; one thrives in dampness, the other in air relatively much drier. Those belonging to the dry rot group, consisting of the *Merulius Lachrymans* and *Coniophoria*, have been found in upper floors of reasonably dry mills and are able to thrive with scant water supply. These dry-rot fungi have been particularly destructive to new buildings, and have generally attacked the larger beams.

The other group—which we may designate as damp rot fungi—consisting of members of the *Polyporous* family, requires a much larger water supply, and is particularly destructive in poorly ventilated basements. Undoubtedly the growth of the latter fungi can be arrested by moderate drying. They seem to grow most luxuriantly when the relative humidity is nearly or quite 100 per cent.

EFFECT OF LOCAL DIFFERENCES OF EXPOSURE

The relative humidity of air in a room or basement sometimes is very different in places only a few feet apart, and in studying cases of infection careful note must be taken of these differences. An example is shown in the accompanying photograph.

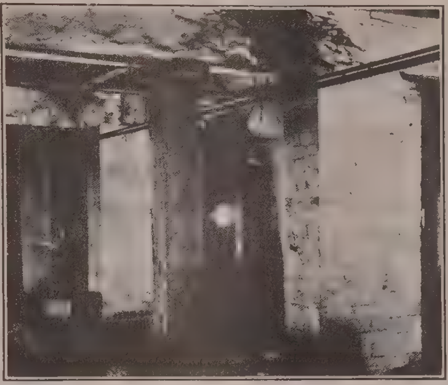
In this case a cold-water pipe passes under several beams in a basement, the average humidity of which is in the neighborhood of 90 per cent. The lower temperature in the vicinity of the pipe causes an increased saturation up to 100 per cent at the pipe. The beams directly over it are rotted for a distance of 18 in. to 2 ft. away, as can be seen in the photograph.

Wood-destroying fungi cannot grow under water or with cells filled with water; rot results from variations of humidity. For example, dry rot was caused in a weaving mill room with 70 to 80 per cent humidity during working hours, because the room decreased in temperature at night, thereby causing precipitation. Extremes of wetness and dryness, however, both prevent dry rot.

VENTILATION AND PAINTING

Ventilation is generally the first preventive measure suggested. Dry wood which is placed in an atmosphere well below the moisture requirements of a given fungus is undoubtedly incapable of infection with that fungus, but ventilation does not necessarily cause drying, as the wood will come into equilibrium with the moisture in the air and will become dryer or wetter in proportion to the relative humidity of the air with which it is ventilated. Therefore, timber ventilated with moist air may have its rate of rotting accelerated rather than retarded. As an example, a thoroughly waterproof covering for a column which had been completely dried would be more useful than a hole through the center for ventilation if this column were used in a moist paper mill.

A heavy coat of paint may accelerate or retard the rate of rotting, depending upon whether it prevents the wood from absorbing or giving up moisture. The condition most commonly met in which paint causes rotting is when it is applied to green timber saturated with water. With sound timbers which are to be placed in a moist atmosphere, a paint will doubtless prove beneficial in proportion to its waterproofing power. "Cold water paint" or "fireproofing" paint containing hygroscopic materials would be expected to accelerate the progress of dry rot, because it attracts moisture from the air and increases the moisture in the wood.


FLOORBEAMS ROTTED BY INCREASED HUMIDITY CAUSED BY COLD WATER PIPE

LIFE OF FUNGI

Dry-rot fungi grow by two methods of reproduction. The common reproductive spore grows over the surface of the plant, but under unfavorable conditions, such as insufficient moisture, the plant separates into small sections which can sprout and grow again when conditions are favorable, and can remain from two to four years in the resting state.

Dry rot is chiefly spread by direct contact, but possibly living spores carried in the air can take root when they find a favorable resting place. Fungi are frequently carried in lumber and spread to other susceptible material by placing it in large piles with scant ventilation. As a result of this, beams are often found more deeply infected in the middle than at the ends.

PREVENTION BY HEATING AND DRYING

Often an infected building can be sterilized by skilful use of its own heating system. Dry-rot fungus is particularly sensitive to heat, a temperature of 108 deg. Fahr. for three hours or 115 deg. for one hour being sufficient to kill it. It is also killed by complete dryness, but ordinary air drying does not destroy it. A badly infected mill was treated four times over the week-end by using its own steam heating plant and raising the temperature to 115 deg. Fahr., but later it was found that the disease had already progressed so far that the beams had to be replaced. To test the effectiveness of the treatment, specimens were taken from forty badly rotted beams and only four showed living fungi, while, on the other hand, beams removed from the mill before it was heat-treated showed a vigorous growth of fungus on cultivation, and also the formation of normal fruiting plants when left lying in the yard.

While these experiments are not absolutely conclusive, they are very encouraging and indicate that the small cost of putting steam on the heat coils is well worth trying, if there be any suspicion of dry rot in a new building. Heating will probably prove more efficient in the few scattered superficial inspections of a mill just completed than it did in this mill, where the growth had been in active progress for two years or more and had deeply penetrated the susceptible material.

HOLES IN COLUMNS AND DOUBLE BEAMS

Sometimes holes are bored in columns and beams for the object of preventing dry rot (see Engineering Record, Vol. 61, 1910, pages 33 and 315), but the common custom of boring green or wet columns just before they are put in place in a building and using moist lumber for double beams *leaves ideal places for the growth of fungus*, as the air in the openings may be nearly saturated with moisture. The holes in the columns have the additional objection of forming a convenient passageway for the fungus to pass rapidly from floor to floor before the building has dried out.

In slow-burning timber construction it has been customary in many cases where an unusually stiff floor is required to use 2 x 4-in. or 3 x 6-in. planks spiked together on edge for forming the floor. This so-called laminated construction is very treacherous so far as rotting is concerned, particularly if the planks are not thoroughly dry when the building is covered. In buildings several stories high it is customary to lay the planks of the lower floors before the walls of the upper stories are complete, thus leaving them exposed to the weather until the roof is put on. Sometimes the floors become thoroughly water-soaked by means of the numerous cracks between the planks. The evaporation of this water is retarded by the great thickness of the floor formed by planks on edge and by the top flooring. This moisture encourages rot. In storehouses for which this form of floor is frequently used, the conditions are worse than in the manufacturing rooms because the storehouses are seldom artificially warmed in winter, thereby giving less opportunity for drying. Several such cases have been reported within a few months.

Mr. Hoxie concludes, as a result of his investigations, that a most thorough study is needed of different kinds of fungi, their life history, and of methods of preventing their destructive work. Pending such study engineers need to scrutinize most carefully the timber structures under their care and adopt such precautions as are dictated by present knowledge.

REINFORCED - CONCRETE COLUMN DESIGN FORMULÆ have been proposed by a committee of the Engineers' Club of St. Louis appointed to investigate the status of the provisions in the present St. Louis building code. This committee recommends that all reinforced-concrete columns shall contain from 1 to 4 per cent longitudinal steel, stayed against buckling either by hooping or by bands. The hooping shall consist of steel rods of uniform pitch not exceeding 4 in. or one-fourth of the coil diameter, nor less than 2 in., and the volume of hooping metal must not be less than 0.75 per cent of the concrete inclosed by the hooping. The safe load (P) on the column in terms of area of concrete within the hooping (C) and total area of longitudinal bars (A) can be found by the formula $P = 750\ (C + 15\ A)$. For banded columns the bands shall have a minimum cross-section of 0.05 sq. in. and be spaced not further apart than twelve times the diameter or least side of the longitudinal rods—in no case more than 12 in. The load on a banded column shall not exceed that indicated by the formula $P = 500\ (C + 15\ A)$.

New Concrete Warehouses and Terminal Plant at New Orleans Will Cover 100 Acres

Devices for Handling Cotton in Piers Make One-Story Warehouse Construction Practicable—Plant to Have an Annual Capacity of 2,000,000 Bales

WORK has been started on a port improvement in New Orleans, consisting of six large reinforced-concrete cotton warehouses, a wharf of the same material, and a railroad terminal yard, that will cover approximately 100 acres of ground and will cost $3,500,000. With the exception of a railroad trestle and a timber apron wharf in front of the wharf proper, the entire construction will be of reinforced-concrete and steel. Based on the proportion of 60 per cent through cotton (that which is shipped to New Orleans on a through bill of lading to other points) and the remainder of consigned and f.o.b. cotton that must be stored for variable periods, it is estimated that the annual capacity of the plant will be 2,000,000 bales. The one-story type of warehouse construction, which is made practicable by the introduction of mechanical devices for raising, lowering, pushing and pulling cotton bales in piles 10 and 15 bales high, and which accomplishes what cotton men had hitherto considered impossible to accomplish, the removal of a bale from any point in a pile without practically breaking up the pile, makes possible an estimated saving over the multiple-storied type of warehouse, with its expensive foundation, of at least 60 per cent per bale capacity. A governing object in the design was to provide a type of construction and equipment that would obtain a minimum rate of insurance both on the buildings and on their contents.

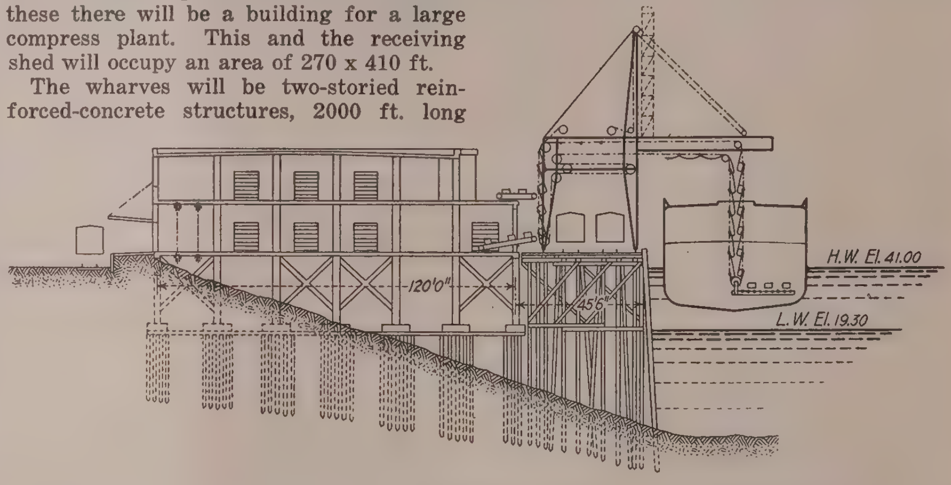
TERMINAL BUILDINGS

The terminal buildings will cover an area of approximately 50 acres and will be supported on creosoted timber piles 35 to 50 ft. long, depending on the weight to be carried. Each of the warehouses for the f.o.b. and consigned cotton will occupy a space 676 x 273 ft. and will be divided into forty-two compartments, each 32 x 100 ft. in plan. South of these warehouses, but separated from them by railroad tracks, will be the warehouses for through cotton. Each of these will have an area of 676 x 173 ft., and will be divided into twenty-one compartments. All of the warehouses will be one story high, with the roofs approximately 35 ft. above the floors of those that will house the f.o.b. and consigned classes and 45 ft. above the floors of those that will house the through cotton. In addition to these there will be a building for a large compress plant. This and the receiving shed will occupy an area of 270 x 410 ft.

The wharves will be two-storied reinforced-concrete structures, 2000 ft. long and 180 ft. in width. The lower story will be 16 ft. 8 in., and the upper 15 ft. 8 in. in height. The wharf proper is to be supported on untreated pine piles driven in clusters, placed 20 ft. on centers each way. As a protection against the teredo the piles will be cut off below low water and capped. Reinforced-concrete columns carried up to the first floor of the wharf, which will be at an elevation of approximately 5 ft. above the highest known water level. The first floor is designed to carry a total load of 500 lb. per square foot, and the second, 350 lb. per square foot. In front of the wharf proper and extending its full length there will be a creosoted pile-apron wharf, 44 ft. wide, on which will be located two railroad tracks. These piles will vary in length from 75 to 90 ft., according to the depth of the water.

South of the warehouses for the cotton that will remain for a period in storage there will be large sorting platforms, each measuring 674 x 130 ft. On each side of these will be two railroad tracks, depressed so that the car floor will be level with the floor of the platforms and of the floors of the warehouses on the opposite side.

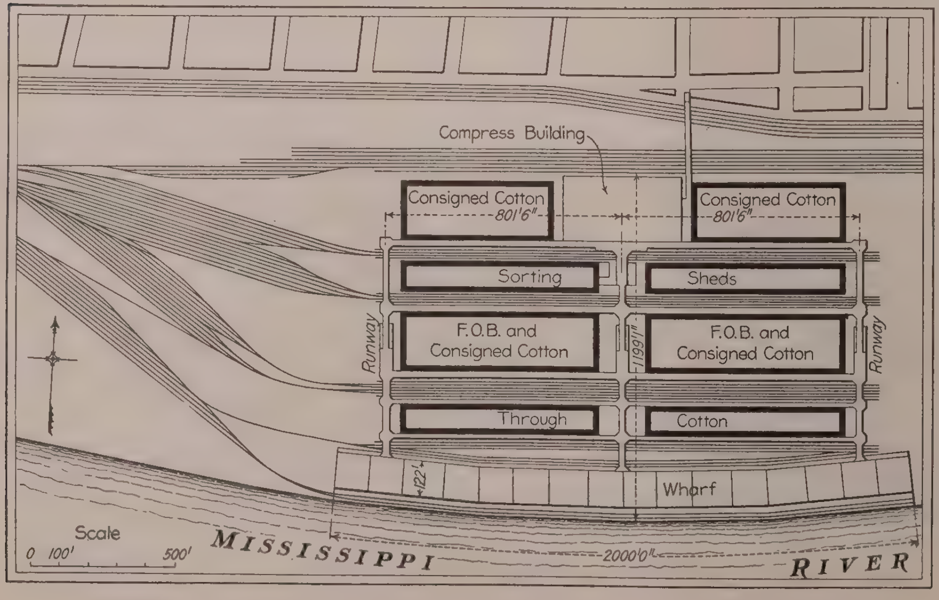
Between the warehouses for the through cotton and the wharf are railroad tracks serving the south side of the through warehouses and the rear side of the wharf. These, too, are depressed and permit of unloading freight from the cars practically within reach of the ship's tackle, while the tracks on the apron wharf allow of direct transfer from car to ship, and vice versa.



ADAPTATION OF COMMONLY USED CONVEYOR APPARATUS TO COTTON HANDLING

There will also be 4½ mi. of overhead and ground-level runways for the accommodation of trains of motor cars and trailers for the conveying of cotton from any one compartment to any other, or from car to ship, or vice versa. The elevated runways will be on a level with the second floor of the wharf and the ground runways on a level with the first floor. Large receiving and, sorting yards will be part of the conveying and transportation equipment.

The terminal yard trackage will have a capacity of approximately 2500 cars, which will accommodate a daily movement of 1000 loaded cars; the equivalent of from 30,000 to 50,000 bales of cotton. In addition to these runways the entire yard trackage, together with the locomotives and freight cars or other equipment, may be used in the transfer of cotton from warehouse compartments to the wharves, and vice versa.



SYSTEM OF TRACKS AND LAYOUT OF WAREHOUSES AND OTHER BUILDINGS

OTHER APPLIANCES

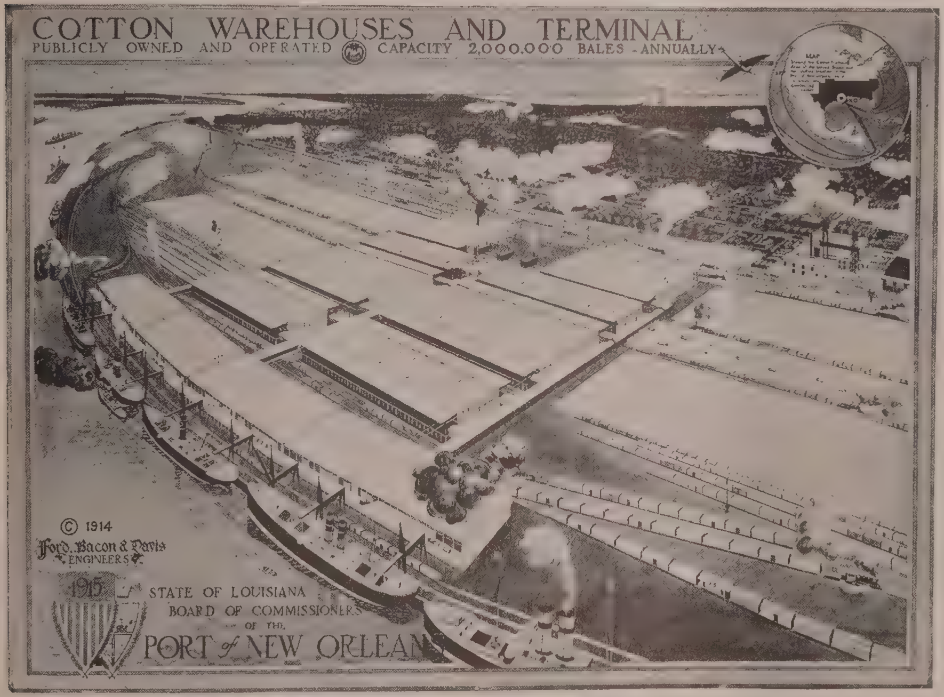
The appliances, other than runways and specially designed bridge cranes for the handling of cotton, will consist of gantry cranes on the wharfs for loading cotton into ships or receiving it from river boats or lighters and continuous conveyors, for cotton handling at the ship's side, similar to those employed for other commodities now located on the wharf front. Still others, of especial importance since they make feasible the construction of the one-story warehouses, are the automatic grapples attached to cranes used in lifting and lowering cotton bales, and mechanical devices for removing bales at any point from tiers 10 and 15 bales high. The handling and transportation of cotton from compress to ship, and vice versa, is mechanical in every feature.

GENERAL FEATURES

The plant as designed is claimed to be entirely original. Other plants embody some of its features, but do not possess them in combination and none of them possess all.

The elevated runways are intended to accommodate any kind of vehicular traffic, including trains propelled by storage batteries, or any other self-propelled motor car, animal power, or any form of traction employed on the usual surface railway.

The classification features of the warehouses are important. The plant will be made up of a series of warehouses designed to receive three different classes of cotton, and each building will be adapted to the particular class it is intended to house. The handling of cotton in trains composed of motor cars and trailers, in which the trail cars are loaded at individual compartments and collected by motor cars into trains for delivery at ship side, or vice versa, is a new idea in cotton handling.



PLANT AS IT WILL LOOK FROM WATERFRONT WHEN COMPLETED

The plant was designed with a view of permitting enlargement in storage capacity, terminal trackage and wharf space as future needs require.

Careful study was also given to efficient operation and maximum earning capacity. For that reason surplus space will be let for the storage of coffee, rice, jute and other standard package commodities.

The plant was designed for the Board of Commissioners of the Port of New Orleans by Ford, Bacon & Davis, engineers, of New York, New Orleans and San Francisco, and the construction is carried on under their direction.

The Typhoid Death Rate in Denver during 1914 was 8.57 per 100,000, a decrease of 30 per cent from the 1913 rate and 62.6 per cent from the average of the previous 10 years. This rate compares favorably with those of the larger Eastern cities, which are as follows: New York, 5.98; Chicago, 6.97; Philadelphia, 7.48; Baltimore, 21.68; Boston, 8.8. Actual numbers in Denver, which has an estimated population of 245,000, were 21 deaths and 169 cases, of which 140 were residents and 29 were non-residents.

Cost Data for Electric Trucks in Freight Houses

Experiences of Two Railroads Are Reported to Railway Engineering Association by Committee on Yards and Terminals

DATA on the use of electric trucks for handling freight in houses are given in the report of the committee on yards and terminals of the American Railway Engineering Association. One road, operating fifty of the trucks, gives costs per truck per year and per month, costs per ton-mile and costs for a certain class of work as compared with hand trucks. Another road gives comparative costs which indicate greater economy in hand trucks, and explains the reasons for this. The committee points out that as the accounts are not kept the same the figures are not directly comparable, and that the operations also are not comparable, being irregular in the first case and continuous in the second. The information is presented substantially as it appears in the report.

A road operating fifty electric trucks states that an actual test by its electrical engineer indicates the following expense for maintenance and current consumption for these trucks working in the aggregate 48,000 hours in an approximate period of 12 months:

Labor and material	$3,630.90
Loss of current, 48,000 hours at 3.3 cents per hour	1,613.70
Cost per truck	104.89
Cost per truck per month	8.74

A report by the same road on the operating cost for handling freight with electric trucks, as compared with hand-truck operation, is as follows:

Eastbound	Tons handled by electric trucks	Electric trucks, (cents per ton)	Hand trucks, (cents per ton)
Vessel to dock	24,050	19.23	29.23
Dock to car	12,383	11.38	13.15
		30.61	42.38
Westbound			
Car to vessel	2,452	21.15	30.30

The fifty trucks were not in operation during all the working hours of the 12-month period. In addition to this, labor trouble was experienced at this point during this time, which compelled the employment of labor unfamiliar with the work.

The costs shown above include only the expense of foremen, truck operators and laborers. The figures show also the tonnage handled at these costs during October, November and December, 1912. On account of the short period the electric trucks were in operation and the small amount of tonnage handled, it is considered that it would not be fair to the electric-truck operation to include all the items of expense incurred at the time of their installation and during their brief use at this point as a basis for the average cost per ton for handling freight.

The electric trucks were transferred to a transfer station in February, 1914, and the average results, based on the first seven months' operation (February-August, inclusive), are as follows:

	Average per month
Maintenance and repairs, including labor and material	$480.71
Cost of current	487.99
Labor expense, including foremen, checkers, truck operators, freight handlers, sealers and coopers	5,496.58
Interest on investment and depreciation of property	778.13
Total average expense per month	$7,243.41
Average number of tons handled per month	17,010 tons
Average cost per ton	42.58 cents
Average number of trucks in use per month	47

Another road furnishes a comparison of cost of operating ten electric trucks and that of hand trucks. In this case the cost with the motor trucks is 25 per cent higher than with the hand trucks, and the reasons for this are given below. This record is for a freight house 30 x 780 ft., covering a period of six days, and with an average of forty-five cars loaded daily.

	Electric trucks	Hand trucks
Tons handled	2,463	2,605
Cost per ton, cents:		
Wages paid truckmen	20.13	20.41
Supplies, current, renewals, interest and depreciation	5.70	.30
Total	25.83	20.71

"In computing the cost of trucking, Sunday work has been excluded and the six days selected from operations in March have been for the purpose of reaching a fair comparison after the men became educated to the use of trucks. There is no question as to their practicability, which has been clearly demonstrated, but the miscellaneous freight for movement (shipments from ferry cars constituting a large proportion of the tonnage) requires so much care to check and distribute as to make the handling exceedingly slow. The character of the freight and the light weight of packages do not admit of the electric trucks being loaded to capacity.

"In consequence, the time required in loading (because of the tedious process in finding the packages, reading the name and consignee and destination) overbalances the gain in movement. When twelve tallymen are employed, the track must be utilized to meet the needs in moving the freight from these various points, radiating distribution to an average of 45 cars. The opposing movements, confusion incident thereto, and complications in meeting all conditions, result in congestion and obstructions in the runways which cannot be overcome."

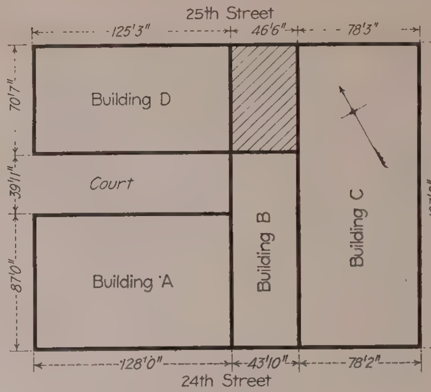
Rapid Construction of Additions to Steel Building

Floor Space Doubled Without Interference with Business—Wide Column Spacing and Unusual Maple Flooring Used

By HERBERT E. MITLER, M. E.
Bing & Bing Construction Company, Inc., New York City

THE new sixteen-story buildings of the National Cloak & Suit Company, located from Twenty-fourth to Twenty-fifth Streets on the west side of Seventh Avenue, New York City, present some interesting features from the designing as well as the construction standpoint. To provide more than 200 per cent additional floor space for a rapidly growing concern, so as to give as rapid possession as possible, and yet not interfere with their regular business, was one of the problems to be solved.

A brief history of the erection of the different buildings will give an insight into the conditions. Referring to the accompanying plain view, building A is a fireproof eleven-story structure erected in 1907, and building B is an eleven-story addition, 40 ft. wide by 200 ft. deep, constructed in 1910. In December, 1913, excavation was started for the latest group, consisting of buildings C and D, each sixteen stories high, and an increase in height of part of building B (shown cross-hatched) from eleven stories to sixteen stories.



LOCATION OF BUILDINGS

These structures were designed not only for the special mail-order business which the company handles, but also for conversion into regular lofts, so that if the company should desire to make a change in its business, or should need more stairways and elevators, the proper facilities could be added. With this in view building C, which now has no elevators or stairways, has framing to provide adequate facilities of this nature if needed in the future.

OPEN FLOOR SPACE DESIRED

The owners found that it was worth a great deal to have as few columns as possible in these buildings, on account of the amount of machinery required for distributing orders and the need for better light and more usable floor space. Therefore only one row of columns obstructs the floors of building C, which requires girder spans of 39 ft. The accompanying photograph of one of the floors shows the fine open space this arrangement gives.

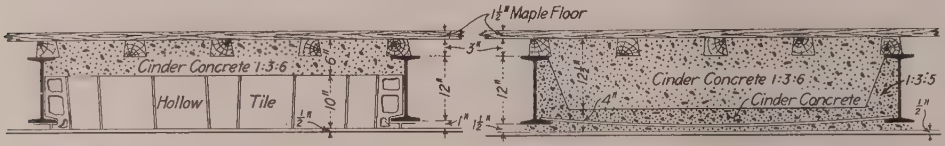
AMPLE LIGHT AND MAXIMUM FLOOR AREA OBTAINED BY WIDE COLUMN SPACING

The girders in this building are all arranged to set east and west, with no girders north and south between interior columns. By means of this design the sprinkler header runs north and south at the west wall of the building, and the branch lines run continuously across the building near the ceiling without having to clear any girders, as is so often necessary in loft building design. These girders are all made up of a pair of 28-in I-beams, and the floorbeams are all 12-in. I-beams except for the first floor and roof.

The steel framing throughout is typical of this class of building and consists principally of Bethlehem rolled sections for columns and floorbeams, designed for a live load of 120 lb. per square foot on the floors.

UNUSUAL FLOOR CONSTRUCTION

The choice of floor construction was arrived at after great deliberation, involving the discussion of costs and adaptability of the flat-ceiling cinder-concrete arch, the hollow-tile arch, and the beamed ceiling of cinder concrete. The least expensive would have been the cinder-concrete floor with the beamed ceiling. However, it was found necessary to adopt the flat-ceiling construction, due to changes continually being made in the arrangement of bins, stock, machinery, etc., for which the additional cost of extensions and alterations to the electrical, sprinkler and ventilating systems might be very large. The accompanying figures show the alternate designs for hollow-tile and flat-ceiling cinder-concrete construction, and it will be noted that the former is 32 lb. per square foot lighter. Considering the relative costs of the hollow-tile and cinder-concrete arches, and also the additional load on the steel due to bottom-construction cinder concrete, the question was decided in favor of hollow tile.



Adopted Design—Hollow Tile
Estimated weight 79.5 lb. per square foot.

Alternate Design—Cinder Concrete
Estimated weight 115.5 lb. per square foot.

COMPARATIVE DESIGNS FOR FLOOR CONSTRUCTION

UNUSUAL FLOORING OF 1½-INCH MAPLE

The floor construction is somewhat unusual in that the flooring is 1½-in. Michigan maple, and also in the method of making a bearing for the sleepers on the cinder-concrete by means of metal clips. The flooring, of which there were 750,000 ft. b.m., was very difficult to get, because this thickness has seldom been used before. The company which finally agreed to execute the contract had so many difficulties that it resolved never to accept another order of this kind.

The diagram shows the floor construction clearly with the exception of the bearing clips. Twelve inches apart on the bottom of all sleepers flat metal strips ⅛ in. thick x 2 in. wide x 6 in. long were nailed in order to give additional bearing on the cinder-concrete. The top of all cinder concrete was level with the top of the sleepers, and the top surface received a coat of waterproofing compound. The flooring was dampproofed very carefully and allowed to dry thoroughly before laying.

OTHER SPECIAL FEATURES

One of the design problems investigated was the method of supporting the five-story addition to building B. It was found to be more economical and satisfactory to design the new column adjacent to this section to support the new floor loads by 46-ft. girders at each floor level. The alternate method considered was the suspension of the additional five stories from the upper ends of the new columns by the so-called cradle construction, but this was found less satisfactory in every way.

Another feature is the reinforced-concrete tank which is used to supply the water for the twelve hydraulic elevators of the buildings. This form of tank was chosen both on account of space conditions, and because of the difficulty experienced in obtaining early delivery of a steel tank to avoid delay in other important work. Some difficulty was experienced in holding the forms and pouring the concrete for this tank, but it was successfully and satisfactorily completed.

RECORD FOR RAPID CONSTRUCTION

Six floors of building C were occupied by the owners in three months and two weeks after the beginning of steel erection, and they took each floor as it was completed within a total time of five months. Building D and the extension of building B were completed in five and one-half months, but the owners occupied seven floors in three months and two weeks after steel erection was started. As near as the writer can ascertain, this time is shorter than that required for any other similar structure erected in New York City. The general contractors were the Bing & Bing Construction Company, Inc., of New York City. I. E. Ditmars was the architect and Weiskopf & Burroughs were the consulting engineers for the steelwork.

Track Construction and Flangeways in Paved Streets

THESE five rules relative to track construction and flangeways at paved street crossings and in paved streets were presented at the recent convention of the American Railway Engineering Association by the committee on signs, fences and crossings:

1. Treated ties should be used, laid on a bed of crushed rock, gravel or other suitable material, not less than 8 in. in depth, placed in about 3-in. layers, each to be thoroughly rammed to compact it.
2. Vitrified tile drains not less than 6 in. in diameter, with open joints, leading to the nearest point from which efficient drainage may be obtained, or with sufficient outlets to reach sewers or drainage basins, should be laid on either side of and between tracks, parallel with the ballast line and outside of the ties.
3. One hundred and forty-one-lb., 9-in. depth girder rail, or of similar section, with suitable tieplates and screw spikes, should be used. Tracks should be filled in with crushed rock, gravel or other suitable material, allowing for a 2-in. cushion of sand under the finished pavement.
4. The ballast should be thoroughly rammed as it is installed to prevent settlement of paving foundations. Two inches of good sharp sand should be placed on top of ballast.
5. Paving must conform to municipal requirements, granite or trap rock blocks preferred. Hot tar and gravel should be poured into the joints as a binder.

Slag and Trap-Rock Concrete

SLAG and trap-rock concrete were recently compared by a 28-day test at Columbia University. Palisade trap-rock was used, separated into ¾, ½ and ¼-in. sizes, and dust, and combined so that the grading was identical to that of the slab, which was used as received from the National Slab Company. The sand was "Cow Bay," a typical Long Island sand, and the cement was a mixture of three approved brands, Atlas, Dragon and Kane. A mixture of 1:2:4 was used. In making up the complement of stone for each batch, proportional amounts of each aggregate were carefully measured by weight. It was thought that this procedure would insure greater uniformity in results. Four batches of each aggregate were made for this test. The resulting average compressive strength per square inch of slab concrete was 2465.5 lb. and of trap-rock concrete, 1975.5 lb. The slab concrete weighed 140.6 lb. and the trap-rock concrete 154.5 lb. per cubic foot.

Literature

For the Civil Engineer and Contractor

New Publications

Working Data for Irrigation Engineers. By E. A. Moritz, C. E., Assoc. M. Am. Soc. C.E. Cloth, 6 x 9 in.; 395 pages; illustrated; diagrams and tables. New York, John Wiley & Sons, Inc. $4 net.

Masonry—A Short Text Book on Masonry Construction, Including Descriptions of Materials Used, Their Preparation and Arrangement in Structures. By Malverd A. Howe, C.E., professor of civil engineering, Rose Polytechnic Institute. Cloth, 6 x 9 in.; 260 pages; illustrated. New York, John Wiley & Sons, Inc. $2 net.

The Modern City and Its Problems. By Frederic C. Howe, Ph.D. Cloth, 5½ x 8 in.; 390 pages. New York, Charles Scribner's Sons. $1.50 net.

Sewage Purification and Disposal. By G. Bertram Kershaw, M. Inst. C.E. Cloth, 6 x 9 in.; 340 pages; illustrated. London, Cambridge Public Health Series, Cambridge University Press.

Hancock's Applied Mechanics for Engineers. Revised and rewritten by N. C. Riggs, professor of theoretical and applied mechanics, Carnegie Institute of Technology. Cloth, 5½ x 7½ in.; 441 pages; illustrated. New York, the Macmillan Company. Price $2.40.

Design of Steel Bridges. Theory and Practice for the Use of Civil Engineers and Students. By F. C. Kunz, C.E. Cloth, 6½ x 9½ in.; 472 pages; illustrated; diagrams and 52 plates. New York, McGraw-Hill Book Company, Inc. $5 net.

Painting Defects—Their Causes and Prevention. By G. W. Thompson, chief chemist, National Lead Company. An address delivered at the eleventh annual convention of the Maintenance of Way Master Painters' Association of the United States and Canada, Nov. 18, 1914, and at the semi-annual meeting of the American Institute of Chemical Engineers, Dec. 13, 1914. Considers paint defects with only minor reference to the materials used, and presents a constructive discussion of such defects as checking, cracking, scaling, blistering, peeling, spotting, discoloration, etc. Paper, 6 x 9 in.; 35 pages; illustrated. G. W. Thompson, Chief Chemist, National Lead Company.

Books Reviewed

Principles of Irrigation Practice

Author, John A. Widtsoe, President, Utah Agricultural College. Cloth, 8 x 5 in.; 496 pages; 180 illustrations. New York, The Macmillan Company, $1.75.

Reviewed by F. H. Newell
Consulting Engineer, U. S. Reclamation Service.

Western engineers and others interested in the development of the West through irrigation, as well as irrigators generally, will find much of interest in this book. While intended primarily for the use of the farmer, it brings together many facts and conclusions which must be thoroughly understood and applied by irrigation engineers and managers. The statements are particularly pertinent at the present time, when irrigation development in a large way is practically stagnant, as they throw light on the reasons why so many apparently attractive schemes have not been financially successful. At the same time they serve to point the way to success in the future through the practice of better systems of agriculture based on a more complete knowledge of the facts.

The reasons for the practical cessation of irrigation construction have been given as coming from reckless financiering, poor engineering, and a host of other causes. The real fact, however, underlying all of these is that the larger investments in irrigation works have not paid. The question of revival of irrigation is answered as in the case of any other business; it will be revived whenever real profits can be seen. There is no lack of money for safe investments. Municipalities or drainage districts are finding no particular difficulty in securing funds, but newly formed irrigation districts, so far as known, cannot borrow money on any terms, simply because millions of dollars of more or less worthless irrigation securities have been distributed throughout the country.

The way out of this condition is evident on studying this book, which shows for the first time in convenient and accessible form some of the problems which the irrigator has to meet, and with these indicates the solution. There is every reason to suppose that by following the advice given and by conducting irrigation farming on the rules of economy and efficiency found necessary in other business, the average irrigator can secure larger returns and will then be able to make larger payments on his indebtedness.

What the West needs to-day is not so much more irrigation projects as it is more and better farmers capable of using the lands already irrigated. When this is done and when the average crop production has been increased, as can be, then there will be little trouble in obtaining adequate funds for more and larger engineering works.

Dr. Widtsoe's book treats largely on the relation of water to soils and to plants, and the behavior of crops under irrigation. He approaches the subject from the standpoint of the physical and biological side, as distinguished from other recent publications which treat a similar class of facts more from the standpoint of the irrigator who has to do with the purchase or selection of a farm, and the measurement and application of water. The advice given has use as above noted, not merely to the irrigator, but in a larger way is of general value in aiding in the upbuilding of one of the fundamental industries of the country—that of crop production—and through this of an increase of prosperity in all other industries, including the work of the constructing and operating engineer.

Descriptive Geometry

Author, Henry F. Armstrong, associate professor of descriptive geometry and drawing, McGill University. Cloth, 6¾ x 10 in.; 128 pages; 114 figures. New York, John Wiley & Sons, Inc. $2 net.

This book, which is presented by the author as the result of twenty years constant teaching of the subject, marks a distinct advance in method of treatment over the older texts on descriptive geometry. It abounds in well-selected practical applications and graded exercises for the students, using subjects which should attract by their evident usefulness. The very essential requirements of clear, well-drawn figures for such a text is also satisfactorily met.

The subject is divided into three parts, apparently more for convenience in presentation than for intrinsic difference in nature of matter presented. Part I consists of six chapters treating the elementary principles in a thoroughly complete manner. These chapters include the following subjects: Use of projection planes, the representation of lines, plans and elevations, traces of planes and lines, shadows of lines and plane figures, the "compound angle," the projection of simple solids, and the shadows of solids.

Part II considers in five chapters, rabattement of planes, points and lines in relative to oblique planes and intersections of the latter with each other, parallel planes and dihedral angles, projection of rectilinear angles and of various figures and solids involving the same, axometric and isometric projection, sections of simple solids, and traces of curved surfaces.

The last third of the book, Part III, gives in four chapters a comprehensive treatment of tangent planes to cones, cylinders and spheres, cases of interpenetration of solids and developments of surfaces, projections of intersections, surfaces of revolution and the screw thread, and finally radial projection and perspective projection.

Both students and teachers should find this book completely satisfactory as a text on a subject which is often attended by great difficulties in class-room presentation. From the mechanical standpoint, both text and figures are a credit to the publishers.

Air, Water and Food from a Sanitary Standpoint

Authors, Alpheus G. Woodman, associate professor of food analysis, Massachusetts Institute of Technology, and John F. Norton, assistant professor of chemistry, Massachusetts Institute of Technology. Cloth, 6 x 9 in.; 248 pages; 15 illustrations. New York, John Wiley & Sons, Inc. $2.

Reviewed by George A. Johnson
Consulting Engineer, New York City.

This is the fourth edition of perhaps the best known treatise on the collective subject which deals with the three prime essentials of human life. In the earlier editions full evidence was shown of the fine hand of the senior author, Mrs. Ellen H. Richards, for many years instructor in sanitary chemistry at the Massachusetts Institute of Technology. Mrs. Richards' death, which occurred shortly after the appearance of the third edition of this book, made necessary a change in authorship, Professor Woodman assuming the senior, and Professor Norton the junior authorship.

This last edition certainly is an improvement over its predecessors, and that is saying a great deal. Much obsolete or obsolescent matter has been dropped, and the various subjects have been revised and brought up to date, so far as practicable, in general accordance with the more modern information and viewpoints. It would be manifestly unfair to criticize the authors for incompleteness of detail, since the scope of the work could not allow of exhaustive discussions of all the subjects dealt with. In general the statements made are fair and unbiased, although here and there creep in the somewhat restricted viewpoints of the teacher, as compared with the broader expressions to be expected from actual workers in the wide field of sanitation.

Like its predecessors, the book is well arranged and in all ways readable. It will continue to occupy a place of much importance in technical libraries.

MORE THAN 100 ENTOMBED MINERS have been saved from certain death by the life savers of the U. S. Bureau of Mines. The bureau now maintains six rescue stations in mining districts, together with eight rescue cars, which visit the various mining camps and train the men in different kinds of rescue work.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Efficiency, 20 Per Cent

SIR: In the Engineering Record of March 13, page 318, there is a statement in the editorial, "Efficiency, 20 Per Cent," that I believe that less than 20 per cent of the cement in concrete is hydrated. This statement was undoubtedly taken from a communication of mine which unfortunately was very loosely worded and would doubtlessly lead to this impression. In this communication I wished to state that I agreed with Mr. Johnson, the author of a series of articles in the Engineering Record, only as to the identity of certain particles in the microphotographs which he showed. I did not intend it to be understood that I agreed with him as to the percentages of these particles present. The results which we have obtained show that the percentage of hydrated material is higher than that stated in the article in the Engineering Record, and not lower.

P. H. BATES.

Washington, D. C.

Hydration of Portland Cement

SIR: It has been called to my attention that certain paragraphs in my article on the hydration of portland cement in your issue of March 13, page 322, may be misinterpreted. Any inference that 80 per cent of cement might be replaced by a corresponding amount of sand because of lack of hydration is erroneous. Such a conclusion is not warranted and would not be reached by a consideration of the article in its entirety, with attention to those paragraphs preceding and following the ones in question.

The results shown in this article are given, not as absolute and conclusive, but as significant and indicative of improvements which it may be possible to obtain in commercial work by further experiments. They have been made public at this time in the hope of interesting others to this end, so that without undue lapse of time the work might be carried to a logical conclusion.

NATHAN C. JOHNSON.

New York City.

Cars for San Francisco Street Railway System

SIR: In the Engineering Record of Feb. 20, page 224, in the discussion of municipal railways of San Francisco, the statement is made that most of the 197 cars which will be in service during the exposition are the most recent type built in accordance with the recommendations of Bion J. Arnold.

In purchasing the 125 cars which were built for the municipal railway system last year it was considered necessary to depart from the recommendations of Mr. Arnold, which had been followed in the construction of the forty-three cars originally built for the Geary Street road, owing to the demand for a wider car than that recommended by Mr. Arnold. In the new cars, which were designed in this office under the direction of M. M. O'Shaughnessy, city engineer, and T. W. Ransom, consulting engineer, the width of the car has been increased from 8 ft. 6 in. to 9 ft. 2 in., which, with the changed seating arrangement, has increased the carrying capacity when crowded from about 130 passengers to 150. At the same time, without reducing the staunchness of the car, the weight has been decreased from 50,000 to 48,000 lb. for each car.

N. A. ECKART,
Assistant City Engineer, in Charge of Railway Construction.
San Francisco.

How Can Annual Reports Be Improved?

SIR: Your editorial "How Can Annual Reports Be Improved," in the Engineering Record of Feb. 27, is both timely and pertinent, and it is to be hoped that the suggestions may be acted upon by those responsible for the preparation of such documents.

You mention two objects to be attained: To account for the expenditures and to record data which are of value. A third object may properly be added—a clear and concise statement of the condition and needs of the works, with recommendations for improvement. Public commissions and the taxpayers generally are usually willing to authorize improvements if the need is plainly shown. Stagnation in departments often may be attributed to failure to present properly technical facts in language that the layman can quickly comprehend. It is not sufficient for an engineer to know what is wanted; he must so tell his story that the busy man will take it in at a glance and the politician recognize that it is for party interest to advance public welfare.

Your criticism of the inclusion in reports of dozens of pages of tables showing details of operation is to be commended, not only because the matter itself is uninteresting and of little value to the general public, but also on account of the considerable increase which is required in the cost of printing. Such tables, as a general rule, are in inheritance from a period before the time of modern office records and their continuance is often an indication of departmental "arterio-sclerosis."

The need of proper financial statements cannot be too greatly emphasized, for they are of as much value as records of operation, if indeed they do not take precedence. No business can be managed properly today without a definite knowledge of the cost and present value of works and the relation between expense of operation and income. To meet this end a complete present valuation of the works should be made by a competent waterworks engineer.

Antiquated methods of bookkeeping have no place in modern business procedure, and usually signify either ignorance or an ulterior purpose. The water department is ordinarily the only part of the municipal organization that brings income. If properly managed in the best interests of the public it should be allowed to supply water at a minimum rate and without dependence on whim or political pressure for appropriations. Oftentimes inadequate waterworks financial statements are used to cloak extravagance in other departments and money is filched by indirect taxation under the guise of water rates. The very best check to such methods is a clear financial statement which will show if the rates charged are excessive or inadequate for the service. The attainment of this object is both simple and inexpensive—a system of bookkeeping designed by an expert accountant to meet local conditions and an annual examination of accounts by a certified public auditor of accounts.

It surely seems both a pity and a disagreeable commentary on public management that municipal service in this country is usually the last to assimilate methods of efficiency in operation.

CALEB MILLS SAVILLE,
Chief Engineer, Board of Water Commissioners.
Hartford, Conn.

SIR: The editorial, "How Can Annual Reports Be Improved," in your issue of Feb. 27, discusses a subject which has been uppermost in my mind for several years. The old style reports were more or less of a farce and practically valueless, as they contained nothing but a mass of statistics, which are on file in departments, and most of them did not even contain tables of unit costs, charts or anything of the kind of value, even as an engineering record.

I thoroughly agree with your article which states that the primary object of the report should be to tell the taxpayers what has been done with their money during the year. This necessitates writing the accomplishments of the year in an interesting manner so that they will be attractive to the ordinary layman.

I also agree with you that the secondary object is to place on record data of engineering value so that in exchanging reports with other cities the experience of one locality may be made of value for the solution of similar problems elsewhere. This, of course, means just to embody in the report the engineering data that is of some real value, and not to publish tables and what might be termed harrowing details of the work. Unit cost records of all classes of work should be published in all reports of public works departments, together with all the necessary diagrams and charts. Organization charts should also be covered in the reports, and the story of the work done should embody sufficient data to bring out the total expenditures of the different classes of work, the mileage of pavements laid, street grades, sewers built, bridges built, etc. This can all be brought out in the story in a few paragraphs. I also agree with you that all tables should be made an appendix to the report.

Every effort should be made to give the annual reports publicity in the newspapers and as you state in your article, this has been done in Philadelphia during the present administration.

Your editorial is very timely and I feel that a thorough discussion will no doubt result in raising the standard of reports of public works. The report of the Bureau of Highways and Street Cleaning of Philadelphia for the year 1914 has just been completed. An abstract was given to the local newspapers to be released on March 8. On the cover and inside title pages of this report an attempt has been made to attract attention, the purpose being to get as many people to read the report as possible. This is done solely for the purpose of getting the co-operation of the public in connection with the work of the bureau. The title of the report has been subordinated and the word "Annual" has been left out. The title reads, "Highways, a Problem in Municipal Housekeeping." There are several subtitles relating to the chief features of the work of the year and in the lower right hand corner are the words "Report for 1914, Bureau of Highways and Street Cleaning, Philadelphia."

WILLIAM H. CONNELL,
Chief, Bureau of Highways.
Philadelphia, Pa.

Trade Catalogs—Few Are Useful as Now Prepared

SIR: A subject seldom seen discussed, and then only in a most perfunctory manner, is that of the trade catalog. In my opinion and in the opinion of a number of engineers, specification writers and purchasing agents of well-known firms with whom I have conversed the average trade catalog is the most abused and wasted form of advertising there is to-day. Judging from the number of catalogs that come to me daily I should estimate that millions of dollars are appropriated yearly for this form of advertisement of which not more than 30 per cent serves the purpose for which it was intended.

From the pile of catalogs on my desk I took one at random. It consisted of an artistic cover, 36 pages of reading matter and pretty illustrations and two pages of abbreviated (useless) "useful information." In all this mass of reading matter there was collectively about the equivalent of two pages worth keeping and as it was impossible to gather it together, the catalog went to the waste basket. The next one, received from a paint manufacturer, consisted of three booklets, sized 4 x 7 in., 5¼ x 8 in. and 7 x 10 in. These were glanced at and also consigned to the waste basket.

The bulletins of a large electrical specialty company were saved for a while, as they were sometimes referred to, but they too eventually went the same course as the others, owing to the difficulty of keeping them. Shortly after this happened some of the materials covered in these bulletins would have been specified had the information been handy, but since it was not, another material, data on which were suitably filed, was used.

And so I could continue indefinitely, showing that easily 70 per cent of the catalogs are thrown away and that only a portion of the remainder are retained.

On the other hand there are a number of loose-leaf and bound catalogs that are retained, given a prominent place in the files and often referred to, their objectionable features being the variations in size and the impossibility of taking out a sheet in a bound volume when occasion requires.

It has been my practice in either specifying or selecting material to give the preference to the firms supplying the best information, all other things being equal. Some time ago a loose-leaf catalog came into the office arranged in almost an ideal way; the firm sending it was immediately investigated and found satisfactory and its materials were thereafter specified. I know of several other similar cases with regard to this particular catalog, and in all of them this firm's materials had not been used until after the receipt of the catalog.

As criticism without a remedy is futile, the following suggestions are offered for the manufacturer's consideration:

First.—As there are two classes of people to whom catalogs are sent, divide the catalog into two different parts, the first part going to the people who could be termed prospects, interested in the story and cuts of the manufactured article, and who buy according to what their friends have bought, not having the necessary knowledge to go into the detail side of the matter for themselves. The second part, and also the first part if requested, should go to the people who write specifications, to the technically trained man and to the actual purchasing agents. This second part should consist of concise information, easily filed and giving all data regarding the material, with clauses that would indicate how specifications should be written to cover the material. These clauses should not prevent competition. To this second class the present catalog is a joke.

Second.—This second part of the catalog should preferably be printed on thin standard letter-size sheets, 8½ x 11 in., punched on the sides for a standard three-ring binder. This size sheet can be attached to a letter or an estimate, and filed in the ordinary letter-file cabinet or in a loose-leaf ring binder. On these sheets as little space as possible should be wasted. Fine type should be used for printed matter. Drawings of material should be given with dimensions. For mechanical equipment, complete charts and tables should be given where possible.

For example, a pump manufacturer should give the following information: (a) Specifications on separate sheets; (b) detail drawings of pump with all dimensions for the various sizes, with notes in fine type calling attention to special features; (c) efficiencies, capacities and horsepower. If this were done the architect or engineer would have all information for general work instantly at hand.

Third.—Omit the phrases "best manufactures," "without equal," etc., as they all say the same. Do not think that the salesman is the only one who should have the information, as there are numberless times when, rather than be bothered with talking to a salesman, another material that is known about will be used.

In closing, I wish to say that a high-grade salesman once told me the best way to sell a good product is to make the purchaser understand it from start to finish, as lots of people think that if full information is not forthcoming there is something to be hidden. I am sure that a number of good manufacturers would enlarge their sales if improvements were made in their catalog system as outlined above.

P. B. TALLMAN,
Engineer, Warren & Wetmore, Architects.
New York City.

A TOTAL LOSS of only $2192 was caused by National forest fires in the East in 1914. Of the 503 fires in the White Mountains and the Southern Appalachians 60 per cent, according to the U. S. Forest Service, were caused by locomotive sparks. Most of the areas were cut-over, and the damage was therefore chiefly confined to young growth. The cost of fire fighting was $1300.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

[*Contributions to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*—EDITOR.]

Small Derrick Erects Large Pipe at Fast Rate

THE traveler shown in the accompanying photograph more than once set 210 lin. ft. of 9-ft. diameter steel pipe in one day. This pipe line, which forms part of a penstock installation described in Engineering Record of March 20, page 355, was supported on steel cradles and concrete piers. The concrete piers were practically finished before erection of the pipe was begun. The way in which the traveler backed away from its work is clearly shown in the cut. The rig was operated with a double-drum hoist run by compressed air. The air for the hoist and for the riveters was compressed at a central station and carried along the work in a small pipe line.

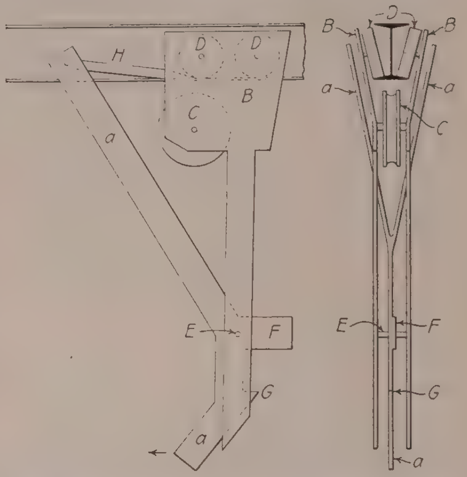
TRAVELER LAID 210 FEET OF PIPE A DAY, BACKING AWAY FROM ITS WORK

Box Gives Caulking Space Under Water Pipe in Muddy Bottoms

A SIMPLE device was used by caulkers on a recent water-main job, where much wet ground and flowing sand and mud were encountered, to obtain caulking space under the pipes. This consisted merely of knocking together a square frame of 2 x 12-in. planks, which was shoved down into the sand and, if necessary, weighted. Then the material inside of the frame was removed, the suction hose of a hand pump inserted, and the work continued without much interference. In some cases where especially bad conditions were encountered and the sand rose up from the bottom, the frame was constructed of a greater depth and sand bags laid inside to hold the bottom down. The measurements of these frames varied according to the size of the pipe.

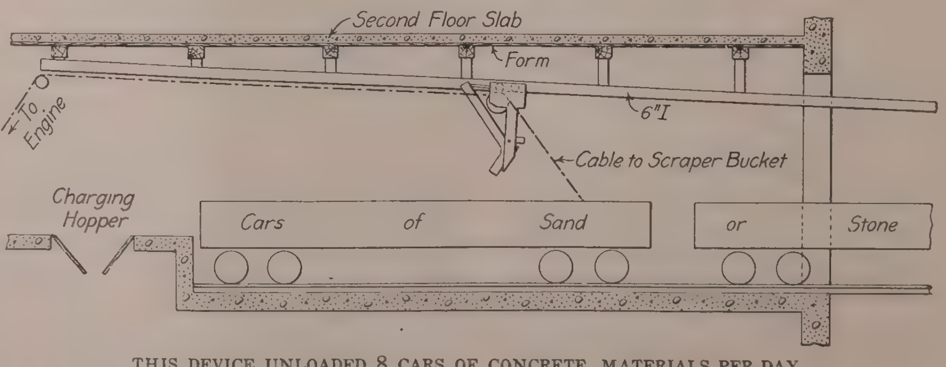
Telpher Charges Concrete Mixer Direct from Cars

TELPHER carriages transporting light scraper buckets were used with success for charging the concrete plant direct from freight cars by the Ferro Concrete Construction Company on the Lippincott Building in Cincinnati. Double tracks were to be run into this building after it was completed, and it was found practicable to place the mixer at the end of these tracks so that as soon as the first floor had been concreted material could be brought directly to the mixer in cars. A small track made of a 6-in. I-beam was placed above the center line of each railway track. These I-beam tracks converged over a hole left in the first floor directly above the charging hopper of the mixer. A scraper, similar to an ordinary dirt scraper, of ½ yd. size for sand and ¾ yd. size for gravel, was used with each carriage. The I-beam tracks were hung from the form work, and were inclined so that the carriages ran downhill by gravity from the hopper. Each carriage was operated by a single line from the drum of a hoisting engine in a manner which can be understood by studying the accompanying sketch.



THIS CARRIAGE WITH ITS ATTACHED SCRAPER OPERATED WITH A SINGLE LINE

Referring to the sketch, D shows the wheels on which each carriage rolled. B are metal plates, one fastened to each side of the traveler, which carry the sheave C. Over this sheave runs the cable which drags the scraper. At E the frame A is pivoted to the frame B. After the scraper has been dumped, the carriage runs back to the point where material is being dug, when a laborer in the car strikes the arm A with a hammer, knocking in the direction shown by the arrow, which pulls in the latch G, on which the bail of the scraper hangs in transit, and allows the scraper to fall to the car. This blow also forces the wedge H underneath the rolling wheels of the carriage, and locks it. In operation this lock was not wholly effective, and had to be supplemented with a short tag-line, which was tied to the end of the car each time to hold the carriage back while the scraper was digging. The laborer in the car then pulls the scraper back a few feet and signals the engineer to go ahead on the single line. The scraper digs a load of material, is raised from the car floor as it comes under the carriage, and is pulled up till it strikes the lever F, which draws out the catch H, and also causes the latch G to stick out. Tension on the line then pulls the carriage with its loaded scraper up to the hopper, where the line is slacked off till the bail of the scraper rests on the latch G, where the scraper hangs while a second laborer tips it up, dumping its contents into the charging hopper of the mixer.



THIS DEVICE UNLOADED 8 CARS OF CONCRETE MATERIALS PER DAY

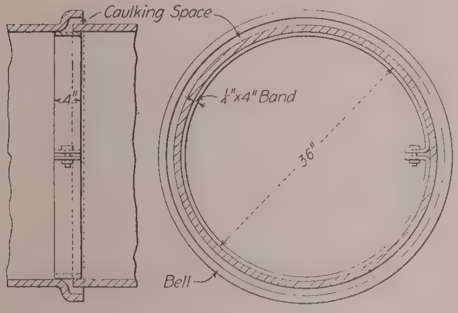
The siding in this case was double-track, and an I-beam track with carriage and scraper was installed over each siding.

The I-beam tracks covered two cars on each siding without switching, and as arrangements were made to have cars switched twice during the day, this rig was used to unload eight cars of material each day. There was practically no room on this contract for storing concrete materials and good runs of concreting depended entirely on the operation of this device, which gave very satisfactory service.

The Engineering Record is indebted to W. P. Anderson, president of the Ferro Concrete Construction Company, for the description of the unloader. The device was described in a general way by Mr. Anderson in a paper presented recently at the convention of the American Concrete Institute.

Inside Band for Solid Joints in Cast-Iron Water Pipe

ON a large water-main contract recently completed a very simple device was used to restrain the molten lead from flowing out on the inside of cast-iron pipe while running the joints.



STEEL BAND ADJUSTED FOR POURING JOINT OF CAST-IRON PIPE

It consisted of a piece of ordinary ¼-in. band iron, 3 in. wide, cut off to a length 5½ in. longer than the inside circumference of the pipe. Each end, 3 in. back, was bent over at right angles and two holes punched into each end so that bolts could be passed through them. Then the band was taken inside the pipes, bent around so as to cover the inside of a joint, and bolted up. The natural spring of the steel band held it tight against the cast-iron in most places, but where slight spaces appeared, a caulker's hammer easily flattened the band in. No inside bracing or support was needed, as the lead chilled immediately upon coming in contact with the band. The device left a good face on the lead. Before pouring, the slight hole where the ends bolted together was plugged with clay.

Blasting Stumps in Gumbo Cheaper than Grubbing

GRUBBING by the usual methods proved difficult in a gumbo soil which had dried and hardened. It was found impossible to pull even the smaller stumps, as the tops broke off before the gumbo would give way. An Oregon highway contractor tried blasting them out, which both removed the stumps and broke the ground for grading. Holes were drilled from 2 to 4 ft. deep and from 4 to 6 ft. apart, in rows about 4 ft. center to center. Each hole was loaded with one stick of 40-per cent powder and from three to six sticks of 20-per cent powder. The cost varied from $3 to $6 per square rod.

The Diesel Engine for the Contractor—Why Not?

Central Diesel-Engine Electric Plant Can Pay for Itself in Four Years on Fair-Sized Job and Show Large Saving Over Present Sources of Power

By H. D. HAMMOND
Associate Editor, Engineering Record

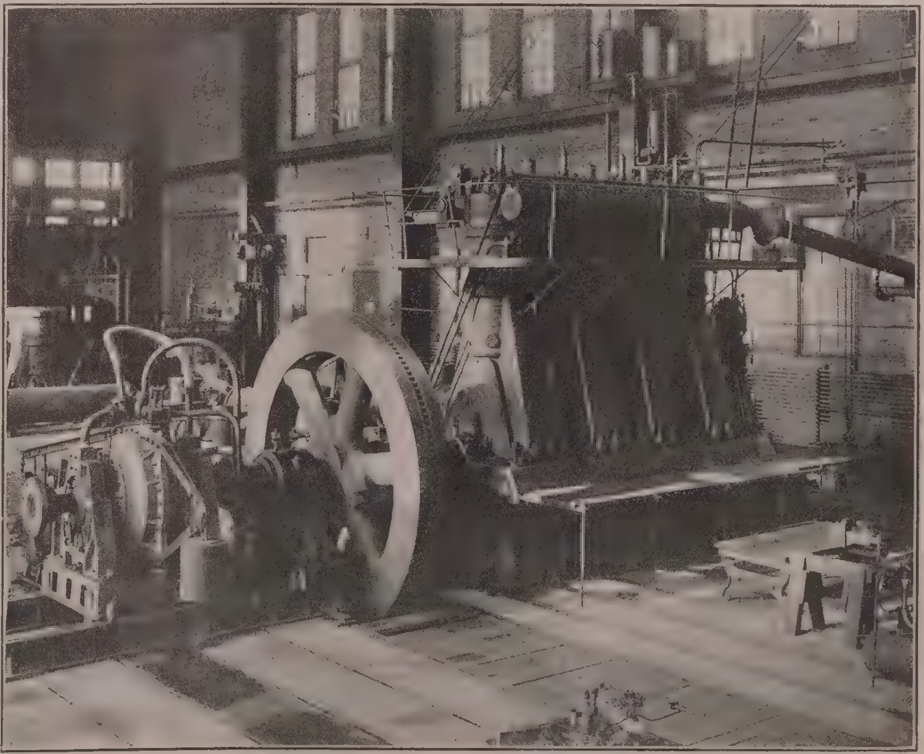
AT least 20 per cent of the total cost of supplying a large job with the cheapest power yet applied to construction work can be saved by using the Diesel engine to develop electricity for operating all the construction plant. The present cheapest source of power is electricity bought from a neighboring power plant. The saving over compressed air as a source of power is over 43 per cent, while the saving over steam piped around the job is not susceptible of estimation, due to the loss of heat and energy in long steam lines. Although there are no direct data as to the actual average loss from this source in piping steam from a central plant over a large job, it is conceded that this loss is very large. Contractors in the East have for some time believed that such loss at least covered the cost of installing a compressor plant and piping air to the job, and have acted accordingly. This assumption will be used in the following comparison.

It must be borne in mind that on a $6,000,000 job, which, we will say, occupies four years and consumes 500 hp continuously during that time, the cost for power delivered to work on the job will run into six figures, and the saving indicated below would give a contractor sufficient bidding margin to secure the job for him at a profit against any firm using the present sources of power supply.

CHARACTERISTICS OF THE DIESEL ENGINE

The disadvantages of the Diesel engine are its high cost and great weight. The advantages are reliability, long life, and a minimum consumption of the lightest and cheapest fuel on the market. To these advantages must be added a thermal efficiency of the engine-generator set of over 31 per cent, and low labor charge for attendance and for installation and maintenance of an electric current distributing system. The engine-generator sets, further, attain a thermal efficiency of over 29 per cent when running on only half load, and also when running on widely fluctuating loads; a point of great importance on construction work. This lower percentage of efficiency has been assumed in computing the cost of fuel, and resulted in a somewhat higher figure than that indicated as correct by recent tests of the Diesel engine.

In the table on the following page, the costs given are from actual installations of the Diesel engine, and from actual cost data obtained on contracts which have used directly applied electric current. The installation costs for wiring are accurate. The installation costs for piping steam or air are assumed, after an inspection of the cost sheets of several jobs run with steam, as no separate costs on this item have come to the writer's attention. The assumption made, in the opinion of one contractor who helped supply this information, may be too low. This contractor figured the cost per horsepower-hour of labor, including firemen and pipe-fitters, as at least 0.6 cents, while here this cost is taken at 0.5 cents. That the costs given in the table for steam and air power are very conservative is shown by the fact that the cost per horsepower-hour is little more for the steam plant than for the job using electric current from a central power plant.



A SOURCE OF POWER NOT YET CONSIDERED BY THE CONTRACTOR

This 508 hp Diesel engine in a recent test ran with a combined labor and fuel cost which was less than the coal bill alone for the best of contractor's steam plants of its size.

Items of Cost	Diesel Engine	Steam Plant	Buying Current
1000-hp plant, 500 hp average developed	....	....	....
First cost; Diesel engine at $50 per horsepower, boiler plant at $10 per horsepower	$50,000.00	$10,000.00	....
First cost; generator at $8 per horsepower, compressor at $10 per horsepower	8,000.00	10,000.00	....
Freight, 300 tons for electric, 200 tons for steam, at $4 per ton	1,200.00	800.00	....
Delivery to job, at $4 per ton	1,200.00	800.00	....
Erection, at $3 per horsepower	3,000.00	3,000.00	....
First cost of transmission line	....	....	$15,000.00
Interest on above investment at 5 per cent for four years	12,440.00	4,760.00	3,000.00
Repairs first four years	1,000.00	1,000.00	100.00
Total overhead expense for each type	76,840.00	30,360.00	18,100.00
Overhead cost per horsepower for each type	76.84	30.36	18.10
Overhead cost per hp-hr. for each type, assuming average of 500 hp for twenty hours a day, 300 days a year, for four years, of 12,000,000 hp-hr	0.00640	0.00253	0.00151
Fuel cost per horsepower-hour; 0.0674 gal. at 3 cents per gallon	0.00202	......	......
Fuel cost per horsepower-hour; 5 lb. of coal at $2 per ton delivered	......	0.00500	......
Cost of electric current per hp-hr. at 1½ cents per kw.-hr	......	......	0.01050
Labor cost per hp-hr. one attendant at 40 cents per hour	0.00080	......	......
Labor cost per hp-hr., five firemen at 30 cents, and one compressor runner at 40 cents per hour	......	0.00380	......
Installation and maintenance of electric distributing lines per hp-hr.	0.00165	......	0.00165
Installation and maintenance of steam lines per hp-hr	......	0.00210	......
Indicated cost of different types of power delivered to work on the job per hp-hr	0.01087	0.01343	0.01366
Delivered to job air only does 70 per cent of work done by electricity, or 500 hp reduces to 350 hp. To produce 500 hp all above expense per horsepower-hour must be increased to X, where $X/500 = 0.01343/350$ or $X = 0.01919$.			
True cost of different types of power at work on the job per hp-hr. is then	0.01087	0.01919	0.01366
Total cost of different types of power at work on job for 12,000,000 hp-hr.	130,440.00	230,280.00	163,800.00
Saving of Diesel engine over steam, per cent of steam, 4.34 per cent.			
Saving of Diesel engine over buying current, per cent of cost of current, 20.4 per cent.			

The weight of the Diesel engine is about 500 lb. per horsepower. The largest single casting of a 500-h.p. unit weighs under 15 tons. The cost, regardless of size, is $50 per horsepower on cars at the factory. We have assumed two 500-hp units, but the cost per horsepower given for the generator is more nearly correct for smaller and more expensive units of 150 to 200 hp. Two cost factors have been entirely omitted. One is the material cost of wiring in an electric installation and of pipe fitting in a steam or air plant, which costs are assumed equal, though there is a balance in favor of the cost of wiring. The other is the cost of electric equipment as compared with steam or air equipment. Electric hoists cost more than skeleton steam hoists by about the value of the hoist boiler. Electric pumps and other equipment cost nearly the same as steam or air equipment. The balance against electric equipment here is offset by the balance in its favor in the cost of a distributing system.

ASSUMED LOCATION AND DISTRIBUTION

Other assumptions made in the comparison are the following. The job, it is assumed, is located in a large coal field, where coal is cheap, and at a distance from the shipping point of the plant corresponding to a freight rate of $4 per ton. Further, it is assumed that it costs $4 per ton to haul the plant from the nearest point of rail delivery to the site. It is figured that the plant must be entirely paid for in four years. This is essential in considering the cost of a boiler installation, but very low for the Diesel engine, these engines lasting twenty to thirty years in stationary practice. By the same token the repair bill assumed in this comparison, which is taken as equal for the two types of plant, is low for the steam plant and high as compared with actual repair bills for the Diesel engine in service.

All necessity for generating high tension current and later transforming it for use is obviated by the possibility of locating the generating plant at the job, and using direct current at 450 to 500 volts without serious transmission loss. The assumption of the cost of a transmission line for the third source of power in the table is moderate, expenditures of more than double this sum having been found economical.

One more thing must be borne in mind. It has recently been proved that the direct application of electricity to a hoist saves 53 per cent of the power consumed by applying air to the hoist to do the same quantity of work. The saving of power on other types of plant is lower, but 30 per cent may be taken as a fair average. This does not allow for any loss of air power in the pipe lines.

ECONOMY ON SMALLER WORK

It is evident that a very large contract has been taken as an example. That the Diesel engine would prove equally economical on a much smaller contract, however, is evident from an inspection of the table. On a contract requiring one-fourth the number of horsepower-hours given here, the three installations could be financed with practically as great a reduction in fixed charges for each case, except possibly for the transmission line. It would only require one fireman and one compressor runner, however, to operate the steam plant, while one operator would still be needed for the Diesel engine plant. This would increase the cost of power at work per horsepower-hour for the Diesel engine at a greater rate than the same cost for the steam or air plant. The respective labor cost of attendance on the Diesel and steam plant become 0.32 cents and 0.56 cents per horsepower-hour. Adding these units to the other figures for each type of plant in the table, it is found that this still shows a saving of nearly 30 per cent for the Diesel engine.

Contractors need not feel afraid of installing a plant that will have to run at half capacity or intermittently. As pointed out, the efficient energy produced in the shape of electric current when such a plant is operating at half capacity is only slightly below the efficiency of the unit running at full capacity. Also, these units can be built as small as 50 hp. These engines can be started almost as easily as turning steam into an air compressor.

Many contractors, especially in the West, are loaded with steam equipment and in no position to try such an experiment. Few are buying any new equipment at this time. On the other hand, an increasing number of firms in recent years have purchased electric equipment which is of no use to them where current cannot be bought from an outside power station. To such the long life, reliability, ease of operation and cheapness of this source of power should appeal.

In making this comparison unfavorable conditions have been assumed in order to bring out the merits of the Diesel engine. One advantage not considered in this comparison is the saving of freight on fuel for remote work. In some locations the freight and haulage on the coal for a large steam plant will exceed the freight and haulage on oil for a Diesel engine plant plus the cost of getting this plant itself to the job. It is rare that good steam coal can be bought delivered to the job at $2 per ton.

So far as is known the Diesel engine has never yet been used on construction work. The makers of these engines and the makers of electric equipment would doubtless be ready, however, to work out an equipment of this kind with any contractor who cared to take advantage of the opportunity it offers.

In conclusion, it must be stated that this paper is intended only to open the subject. Probably no one man or firm has all the data necessary to treat the subject exhaustively. It is hoped, however, that discussion and criticism will follow which will bring out more complete information than the writer has been able to gather in the three years since he became interested in the subject. Such discussion would be welcomed by this paper.

Guys Steady High Steel Tower During Moving

By C. E. HENDERSON
Assistant City Engineer, Port Arthur, Ont.

A STEEL TOWER 120 ft. high, supporting a 50,000-gal. water tank, has just been successfully moved about 200 ft. by Messrs. Beaton & McLeod, contractors, in Fort William, Ont. The tower is the property of the Ogilvie Flour Milling Company, Ltd., and was on the site of the contemplated 250,000-bu. addition to their elevator, which addition is now being constructed.

After new bases had been prepared for the tower, moving was begun. The top of the tower was securely guyed in four directions by ¾-in. steel cable, which was carefully played out, or taken up, as the tower moved, by means of a set of falls at the lower end of each guy. The feed pipe and frost box in the center of the tower were supported on cross timbers. The four posts of the tower, which were 30 ft. apart on each side, were made up of two channels each. To these posts were bolted 8 x 16-in. timbers, 40 ft. long, which were used in jacking up the tower to put rollers under it. The track was composed of 12 x 12-in. timbers placed on the frozen ground and leveled up with blocks. The skids placed under the tower posts were two 8 x 14-in. timbers 40 ft. long, each having two maple shoes 3 x 12 in. x 14 ft. long. The rollers were of maple, 7 in. in diameter and 6 ft. long. Transverse timbers 8 x 14 in. were used to keep the tower posts from spreading.

Power for hauling was furnished by a team, attached to a ⅞-in. rope, which worked through a pair of double blocks. This tackle was used as a luff on the main ¾-in. steel cable, which worked through a pair of triple blocks.

Seven men were employed, and the entire operation required about 5 days. The actual time of moving, however, was only 3½ hours.

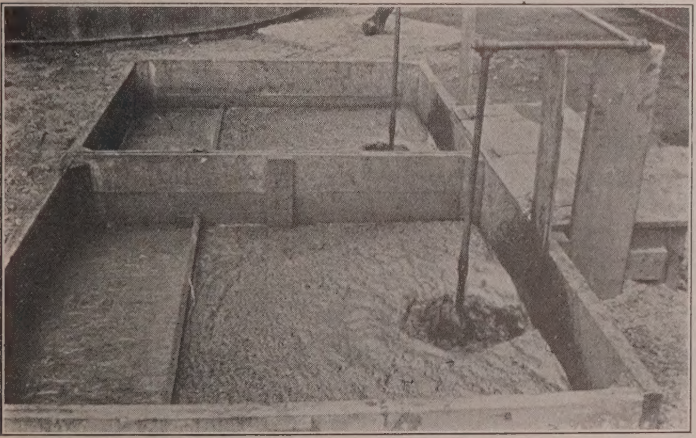
NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

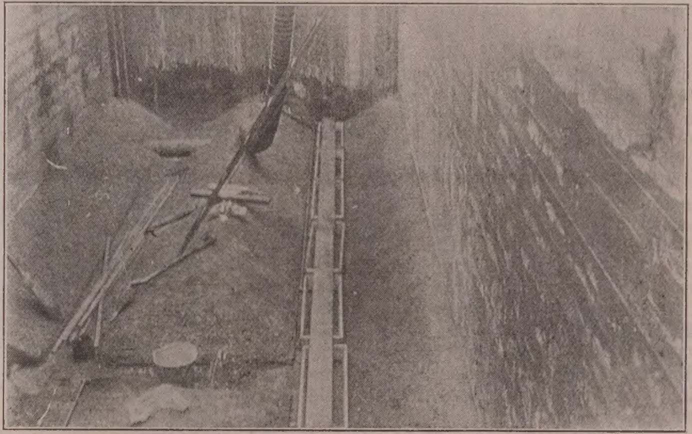
Activated Sludge Possibilities Stir Middle West Sanitarians

Enthusiasm over the possibilities of activated sludge to care for the sewage of large cities where land values are usually high and nuisances must be eliminated ran high in Milwaukee, March 19, at the one-day meeting of the Lake Michigan Water Commission. The sewage testing station on Jones Island was inspected, much interest being shown in the laboratory tests on activated sludge and in a half-equipped fill-and-draw tank in which it is proposed to treat 150,000 gal. daily. Later on it is proposed to build a baffled tank for continuous operation. Poulé air lifts will effect the agitation and furnish air. Settling will take place in the last compartment which will have a sloping bottom to return the sludge to the agitating chambers through slots under the baffles.

Eight papers were presented in the afternoon on the subjects relating to the sanitary conditions of Lake Michigan waters. E. D. Rich, State sanitary engineer of Michigan, in outlining the law under which he is working, evoked expressions of surprise and congratulation when he stated that the source of his finances was the general funds of the State and the amount was not limited.



POULÉ AIR-LIFT AGITATING SLUDGE AT MILWAUKEE TESTING STATION



AIR-DIFFUSERS PLACED IN SLOPING BOTTOM OF ACTIVATED SLUDGE TANK

Dr. George B. Young, health commissioner of Chicago and president of the organization, presented data on bacteriological condition of water from various Chicago intakes. Bacteria dies out rapidly in traversing the tunnels a few miles to the inland pumping station.

H. S. Baker assistant city engineer, Chicago, supplemented this paper with a description of the sterilizing plants on the cribs installed by the city. The question of a future meeting place and the nomination for officers are left to the secretary and president, Prof. E. Bartow and Dr. Young.

Prizes for Plans for Facilitating Street Traffic

Prizes of $300, $200 and $100 have been offered by the Municipal Art Society of New York, for the three best plans for engineering changes to facilitate traffic at street intersections.

Competitors may submit plans which contemplate the condemnation of any part of the four adjacent blocks, the creation of new streets, the changing of the level of streets or any other radical departure from the present street arrangements, although the financial effect of changes in the streets is important and any drastic change which would mean the destruction of valuable buildings would probably not be acceptable unless it offered satisfactory compensation in the increase in real-estate values.

Details of the competition may be obtained by addressing the society at 119 E. Nineteenth St., New York.

Contract Let for Main Canal of Everglades Drainage Project

Twenty million cubic yards of earth excavation are involved in a contract let March 8 to the Furst-Clark Construction Company, of Baltimore, for the construction of the St. Lucie canal from Lake Okeechobee, Florida, to the St. Lucie River. This the main unit of the plan of the Everglades Engineering Commission for controlling the waters of the lake and preventing their overflow into the Everglades. The whole project, which includes the construction of a number of other canals from the lake to tidewater, was outlined in the report of the commission abstracted in the Engineering Record of Jan. 24, 1914, page 119.

The St. Lucie canal, which is to be navigable, will be 24 mi. long. At the lake end it will have a bottom width of 120 ft. and depth of cut of 14 ft. It will gradually widen out to a bottom width of 160 ft. at the river end. The greatest depth of cut will be 28 ft.

Isham Randolph, Marshall O. Leighton and Edmund T. Perkins constitute the Everglades Engineering Commission. The above-mentioned report by the commission followed a favorable finding in August, 1913, by F. C. Elliot, acting drainage engineer.

Pan-American Scientific Congress to Meet in December

The second Pan-American Scientific Congress will open in Washington, D. C., Dec. 27. This is in accordance with a resolution of the first congress held in Santiago, Chili, in December, 1908. Among the sectional meetings will be those devoted to "Conservation of Natural Resources, Agriculture, Irrigation and Forestry," "Engineering," and to "Transportation, Commerce, Finance and Taxation."

Pennsylvania Runs Electric Test Train in Philadelphia

An electric test train of two cars was run March 18 over the Pennsylvania Railroad from Bryn Mawr to Overbrook in the Philadelphia electrified zone. The trip is reported to have been entirely successful. Regular electric service will be inaugurated about June 10.

Railway Engineering Association Convenes in Chicago

Discussion Centers on Work of Six Committees—
Rail, Track, Roadway, Ballast, Iron and
Steel Structures and Economics of
Railway Location

Last year's record attendance was slightly bettered by the sixteenth annual convention of the American Railway Engineering Association, held in Chicago March 16-18, when 490 members and 238 guests were registered. The healthy condition of the association was clearly delineated in the address of W. B. Storey, Jr., president of the association.

Mr. Storey, while reviewing briefly the year's events of interest to railroad engineers, confined himself largely to the affairs of the society. The society has increased its membership to 1236, a net gain of 89, and now has about $17,000 in the treasury. Nevertheless there is urgent need of more funds, not only to finance various tests that different committees recommend, but even to publish the increasing volume of reports presented by the committees. The "Manual" is to be revised and reprinted as soon as possible, at an estimated cost of $7,000, and the board of direction also proposes to publish a general index at an early date. The members of the association are urged to enlist as many new members as possible, while the committees are asked to consider the opportunities for reducing printing costs by condensing their tabulated and other data as far as possible by the use of such expedients as charts.

The investigations of the rail committee have been conducted at the expense of the American Railway Association. Partly on account of the financial situation and partly because of a feeling that the expenditures thus far made have not borne the results expected, this support has been withdrawn, which will necessitate the virtual stopping of the work. Mr. Storey believes that if the members, as engineers, will point out to the operating people that any improvement, however small, in the matter of steel rails will justify any expenditure that has been or may be made, it may be possible to get further assistance from the American Railway Association. He hopes such assistance may be forthcoming within another year.

Mr. Storey also urged the membership to use its efforts to bring about a change in the fiscal year to coincide with the calendar year, and thereby enable maintenance men to plan their year's work intelligently.

Economics of Railway Location.—The conclusions of this committee were subjected to one of the liveliest discussions of the convention. Prominent in the discussion were L. C. Fritch, of the Canadian Northern; A. S. Baldwin, of the Illinois Central; G. J. Ray, of the Delaware, Lackawanna & Western, and Charles S. Churchill of the Norfolk & Western.

A. K. Shurtleff, office engineer of the Presidents' Conference Committee; Maurice Coburn, of the Vandalia and J. deN. Macomb, Jr., of the Atchison, Topeka & Santa Fé, brought in a minority report on the economics of railway location, as they could not agree with the foot-ton method of calculating the fuel consumed as referred to in the committee's conclusions 12 and 13. Conclusions 1 and 2 of the minority report were accepted and the necessary changes made.

Rail.—The committee came out strongly in favor of the A. R. A. "A" section and its recommendation that it be used as standard for 90-lb. rail was adopted. No changes below 90 lb. from the usual practice were recommended.

Dr. P. H. Dudley, of the New York Central, presented the results of an investigation of transverse fissures, which had not yet been presented to the committee. The conclusions drawn by Dr. Dudley were that the coning of the wheels and the shape of the tread is not satisfactory and that there should be less coning and a wider tread covering the full width of the rail head. He also added that he thought wheel pressures were too great, not only for the wheel but also for the best care of the rail.

Iron and Steel Structures.—A. W. Carpenter, of New York Central, offered a motion that the signal and bridge functions be interlocked in such a manner that none of the functions for opening can be performed until the signals have been set at stop indication; also that functions be interlocked with each other so as to be performed in a predetermined order both for opening and closing. C. E. Lindsay, of the New York Central, offered a slight amendment in the wording and the motion was carried.

The committee's recommendation as to increasing bridge clearances from 14 to 15 ft. was defeated. W. H. Courtenay, of the Louisville & Nashville, opposed the recommendation as a dangerous precedent to erratic legislation. C. F. Loweth, of the Chicago, Milwaukee & St. Paul, and C. H. Cartlidge, of the Chicago, Burlington & Quincy, also objected to the measure.

Track.—The committee strongly urged the adoption of Dec. 31 as the end of the fiscal year and asked the officers of the association to communicate again with the American Railway Association on the matter.

Mr. Lindsay, of the New York Central, urged a drawing for the "Manual" showing an interlocking slip switch which can be operated by hand before the interlocking is complete.

Roadway.—John G. Sullivan, of the Canadian Pacific, moved that the measurement of excavated material should be the original space occupied, regardless of the classification. His motion was carried. At the suggestion of J. L. Campbell, of the El Paso & Southwestern, the recommended width of roadway specified under general contract requirement was referred back to the committee as not being consistent with practice.

Ballast.—The motion of H. E. Hale, chairman, that the ballast sections recommended be inserted in the "Manual" was lost. Hunter McDonald, of the Nashville, Chattanooga & St. Louis, led the opposition, stating that he felt that there was no necessity for banking the ballast up against the end of the ties and that it was a detriment to the track. He further said that as the ballast at the end of the tie becomes clogged with any dirt it begins to act as a pump, forcing the clay up through the ballast and fouling it. The sections proposed, according to Mr. McDonald, could only be carried out on roads having a sufficient number of tracks to enable them to shift the traffic while the section was being introduced. He also stated that a great deal of the foul ballast is due to the fact that it has been tamped too much. Mr. Hale defended the ballast section, saying that it was selected because it could be made of gravel or cinders and permitted adding a stone ballast at a later date. He also said that the shoulder was not so much for holding the track in line as for thoroughly supporting the end of the tie and preventing the ballast from kicking from under the ends. Mr. McDonald answered this statement, saying that if a 10-in. border is left from the end of the tie at a level with the bottom of the tie it will hold the ballast in just as well. Mr. Lindsay, of the New York Central, and J. R. Leighty, of the Missouri Pacific, supported Mr. McDonald.

Other Committees.—The conclusions and recommendations made by the remaining committees evoked slight, if any discussion, and were approved.

In the Engineering Record of March 20, page 374, may be found the abstracted reports of all the committees and in the news section, page 382, the officers elected for the ensuing year. Paul Didier, principal assistant engineer, Baltimore & Ohio; Hadley Baldwin, assistant chief engineer, Cleveland, Cincinnati, Chicago & St. Louis; C. E. Smith, assistant chief engineer, Missouri Pacific; F. E. Turneaure, dean of engineers, University of Wisconsin, and D. J. Brumley, valuation engineer, Illinois Central, were elected members of the nominating committee. C. E. Lindsay, division engineer, New York Central, was elected a director, by the board of direction, to fill the vacancy created by the election of John G. Sullivan as second vice-president.

Engineers Discuss Electrification

A discussion on the operating results of the electrification of steam railroads taxed the capacity of the rooms of the Western Society of Engineers in Chicago, March 15, to their utmost. George Gibbs, consulting engineer of the Pennsylvania and Norfolk & Western railways, and Edwin B. Katte, chief engineer of electric traction, New York Central Railroad, presented papers dealing with the roads with which they are connected. W. F. Murray, consulting engineer, New York, New Haven & Hartford Railroad, and C. A. Goodnow, assistant to president, Chicago, Milwaukee & St. Paul Railway, sent in papers which were read. Notes from Mr. Murray's paper will be found on page 394.

Dean W. F. M. Goss pointed out that electrification was only in the experimental stage and that the proposed Chicago terminal zone includes more track than the total miles of electrified steam roads now in existence. Charles S. Churchill, assistant to president, Norfolk & Western Railway, stated that for successful consideration a sufficient traffic density was necessary. In the case of his road, 60,000 tons per day was considered the minimum.

Fountain to Commemorate Completion of Engineering Work

An accompanying picture shows the Fallsway Fountain, which has recently been erected in Baltimore to commemorate the completion of the Fallsway, an important municipal improvement which has been followed from time to time by items and articles in this journal.

The improvement which the fountain commemorates represents an expenditure of approximately $2,000,000. The Fallsway is now one of the best lighted and most traveled thoroughfares in the city and presents a wonderful contrast to what it hides—an open sewer through the heart of the city, lined with ramshackle buildings. It has been transformed into a broad boulevard. Calvin W. Hendrick, as chief engineer, was in charge of the improvement.

FOUNTAIN COMMEMORATES COMPLETION OF THE FALLSWAY, BALTIMORE

Membership of Boston Society Passes 1000 Mark

At the annual meeting of the Boston Society of Civil Engineers, held March 17, it was announced that as the result of a recent campaign the membership of the society has been increased to more than 1000.

Chicago Engineers Discuss Commercial Side of Profession

Subdivision 63, the engineers section of the Chicago Association of Commerce, at a meeting March 19 adopted the following five-plank platform:

1. To give the officers and the committees of the association any desired assistance in shaping public policy or the policy of the association, on subjects where expert engineering advice is necessary. 2. To carefully consider engineering subjects in which the public is or should be interested, and to prepare careful unbiased statements for dissemination to the press, through the proper officers of the asso-

ciation, that the public may have a clear understanding of these subjects. 3. To place on file with the association the section's records and references, that upon application the outside world may know that Chicago is the great central market for engineering skill and ability. 4. To furnish, when desired, a list of engineers, experts in their lines, with a statement of their experiences and of their charges, to aid any fellow member in selecting the proper man for work he may have in hand. 5. To give business to fellow members—all other things being equal—and at all times to strive for the advancement of the city and the association.

The fourth plank was adopted with the proviso that it be sanctioned by the ways and means committee of the association.

Rumors Regarding New York Utility Commission Appointments

Rumors in the New York papers say that the Governor has under consideration the advisability of appointing Henry W. Hodge of Boller, Hodge and Baird, consulting engineers, New York, and Kingsley L. Martin, former commissioner of bridges, New York City, to the Public Service Commission of the First District. The present commissioners are under charges and hearings thereon were held this week.

License Law Approved Only as Third Alternative

Only as a third alternative have the directors of the Western Society of Engineers approved the proposed license law for structural engineers in Illinois. The first measure mentioned in resolutions passed March 9 and the one preferred is the repeal of the architects license law, or its amendment in such manner as to permit equal privileges to engineers and architects. The second remedy suggested as next desirable is to obtain the adoption of a State building code that will secure the protection of the public without hardship either to architects or to engineers. In the event that neither of the above remedies can be brought about, the board approves the action of the committee in urging the passage of the bill, or a modification of this bill retaining the essential provisions on which the committee has been working for two years.

In the preamble of the resolution it is specifically stated that the board seeks no special privilege for engineers and has serious doubts of the wisdom of regulating engineering through State license, as a general proposition, but it believes that a special emergency exists in Illinois and can be met only by additional legislation.

Provisions of Bill

The bill provides for the appointment by the Governor of a State board of examiners of structural engineers composed of five members, one of whom shall be a professor in the civil engineering department of the University of Illinois. Applicants for examinations must have six years' experience as a structural engineer, two of which shall be in responsible charge of work. A fee of $20 shall accompany applications for examination, and if the examination be passed satisfactorily a further fee of $30 is required before the license is issued.

Persons engaged in the practice of structural engineering in Illinois on the date of the taking effect of the act shall be entitled to a license without examination, upon making application and paying a fee of $50. Structural engineers licensed under the laws of any other State or territory of the United States or any foreign country, in which the requirements are equal to those in Illinois, can receive licenses upon application and the payment of a fee of $50, without examination.

The act does not apply to draftsmen, superintendents and other employees working for structural engineers duly licensed. Moreover, it does not cover superintendents of construction of buildings employed and paid by the owners, provided such superintendents act under the supervision of a licensed structural engineer.

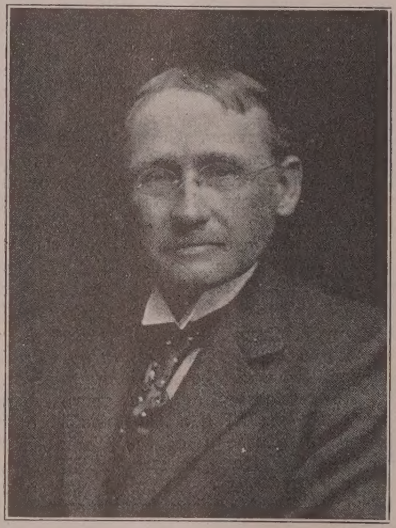
The penalty for practising without a license shall be a fine of not less than $10 and not more than $200 for each and every offense.

Every licensed structural engineer who desires to continue the practice of his profession shall pay to the secretary of the examining board $10 each year. The board shall have the power of revoking licenses upon the showing of due cause.

Frederick W. Taylor, Efficiency Expert, Dead

Frederick W. Taylor, who died in Philadelphia, March 21, was the originator of the modern movement for scientific management in machine shops, the inventor of methods of treating high-speed tools and the author of important technical papers. He was born in Germantown, Pa., in 1856 and was first employed by the Midvale Steel Company in 1878. He served successively in the capacities of gang boss, assistant foreman, foreman of machine shop, master mechanic, chief draftsman and finally as chief engineer.

Originator of Scientific Management of Labor in Industrial Processes



FREDERICK W. TAYLOR

In 1889 he began his special work of reorganizing the management of manufacturing establishments and, from this time on, his life was devoted principally to the simplification of industrial processes to reduce costs and increase outputs.

In 1900 he received a gold medal from the Paris Exposition in recognition of his invention of the Taylor-White process for treating high-speed steel tools, and in 1905 and 1906 he was president of the American Society of Mechanical Engineers.

He is best known to civil engineers through his collaboration with Sanford E. Thompson on works on concrete. These are entitled "Concrete, Plain and Reinforced" and "Concrete Costs." Among his other writings are "The Art of Cutting Metals," "Shop Management" and "The Principles of Scientific Management."

Amend Oregon Paving Specifications

A bill has been introduced in Oregon to assure open competition between patented and non-patented pavements in all road construction. The bill instructs the State engineer to draw certain specifications for asphaltic concrete pavement that will not infringe upon any patented pavement, and provides that these specifications shall be furnished free to each county of the State upon request. When advertising for bids the county court shall invite bids on these, together with any other type of pavement that may be deemed appropriate, whether patented or not patented.

Street Depression Proposed to Separate Grades at Reading

Depression of Penn, Cherry, Franklin, Chestnut and Seventh Streets in Reading, Pa., is proposed by Edmund B. Ulrich, city engineer, and Emil L. Neubling, chief engineer of the Bureau of Water, as the best means of separating the grades of the streets from that of the Philadelphia & Reading Railway. In a report made recently to the Mayor and city council they state that inasmuch as the railroad would not permit an ascending grade on their down traffic elimination of the grade crossings by changes in the track profile would necessitate the extension of construction operations far beyond the city's limits and the city's share of the expense would be almost prohibitive.

Plans and estimates accompany the report. Its authors state, however, that the elaboration of the plan requires more study, time and assistance than they can devote to it. They recommend, therefore, that a proper study be made by a commission of three, consisting of a qualified engineer, experienced in the abolition of grade crossings, an architect and a business man versed in local real estate values, the commisison to be empowered to hire engineers and architects to prepare the necessary plans and estimates.

Offers New York Track Rights to Save Separate Extensions

Ralph Peters, president of the Long Island Railroad, has notified the New York Public Service Commission, First District, that it will consider a proposition from the city for trackage rights for the dual-system rapid-transit trains from Corona, the present terminus of the city-owned line, to and through Flushing to Whitestone and to the city limits at Little Neck over the tracks of the Long Island Railroad. Mr. Peters estimates that it would cost the city about $6,800,000 to build extensions to Whitestone and Little Neck and only $500,000 to build a connection between the city line at Corona and the Long Island tracks near Whitestone Junction. He suggests a ten-year contract with the privilege of renewal for the same period of time.

News of Engineering Societies

The Engineers' Club of Seattle has recently been incorporated under the laws of the State of Washington.

The Engineers' Society of Western Pennsylvania will hold a meeting April 20. G. S. Stickney, consulting engineer, will speak on the Lake Erie and Ohio River Canal.

The Princeton Engineering Association held a meeting at the Princeton Club, New York, March 23. E. P. Goodrich, consulting engineer to the president of the Borough of Manhattan, spoke on city planning.

The Brooklyn Engineers' Club heard J. Loewenstein, assistant engineer of the American Bridge Company, speak March 25 on the construction of the arch span of the Hell Gate Bridge in New York City.

The Detroit Engineering Society will hold a meeting in that city April 22. H. M. Brinckerhoff, of Barclay Parsons & Klapp, consulting engineers, of New York City, will speak on the Detroit traffic situation.

The Civil Engineering Society of the Massachusetts Institute of Technology held a smoker in the Technology Union March 16. F. H. Newell, consulting engineer of the U. S.

Reclamation Service, spoke on irrigation engineering.

The Engineers' Club of St. Louis was entertained by the Collimation Club of the same city March 23. F. H. Newell, consulting engineer for the U. S. Reclamation Service, spoke on engineering and economic features of the reclamation construction.

The Municipal Engineers of the City of New York held a meeting at the United Engineering Societies Building March 24. Louis Nixon, consulting engineer to the president of the Borough of Richmond, presented a paper on the development of New York Harbor.

The Pennsylvania Branch of the American Society of Engineers, Architects and Constructors elected the following officers at a meeting held March 20 at Philadelphia: Chairman, Col. John M. Carson, Corps of Engineers, U. S. A.; first vice-chairman, Oliver R. Barry; second vice-president, Manton B. Hibbs; secretary, T. H. Boorman. A resulution authorizing the secretary to apply for affiliated membership with the Engineers' Club of Philadelphia was also voted upon and passed.

The Boston Society of Civil Engineers held its annual meeting at the Boston Society club March 17, at which the following officers were elected for the ensuing year: President, Charles R. Gow; vice-president, R. E. Curtis; secretary, S. Everett Tinkham; treasurer, Frank O. Whitney; directors, E. M. Blake and G. C. Whipple. The Desmond Fitzgerald Medal for the best paper read during the past year was awarded to J. R. Worcester. F. H. Newell, consulting engineer of the U. S. Reclamation Service, lectured on the engineering and economic results obtained by the U. S. Reclamation Service.

Personal Notes

Joseph R. Thatcher, county engineer of Warren County, New Jersey, was recently elected president of the New Jersey State County Engineers.

James A. Smith has assumed the presidency and active management of the Cleveland Engineering Construction Company, Cuyahoga Building, Cleveland.

C. A. Stephens, formerly assistant engineer of the Texas City Transportation Company and the Texas City Terminal Company, has been appointed chief engineer.

Francis Mason, of Mason, Hilton & Company, engineers and contractors, of New York City, was recently elected president of the Association of Harvard Engineers.

Alfred D. Flinn, deputy chief engineer of the New York City Board of Water Supply, has been elected one of the vice-presidents of the Association of Harvard Engineers.

Arthur L. Mullergren, consulting engineer, of Poteau, Okla., has become connected with the organization of Benham Engineering Company, consulting engineers, of Oklahoma City, Okla.

Harold E. Ketchum, lately in charge of viaduct construction in Kansas City, Mo., has been appointed superintendent of construction in charge of the Detroit-Superior high-level bridge in Cleveland.

Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, was also appointed a member of the Federal Trade Committee of the Chamber of Commerce of the United States.

A. A. Matthews, formerly assistant engineer maintenance of way of the Missouri, Kansas & Texas Railway, has been appointed engineer of maintenance of way succeeding L. F. Lonnbladh, promoted, as noted elsewhere in these columns.

J. E. Root, formerly office engineer on the sewage investigation work being conducted by the Public Works Department of Cincinnati, has been appointed designing engineer. Mr. Root was appointed to his position in the sewage investigation division in April, 1912.

Charles Warnock has been appointed manager and treasurer of the Montreal office of Robert W. Hunt & Company, engineers, succeeding Charles C. Whittier, who has been transferred to the company's Chicago office. Mr. Warnock's appointment will be effective April 1.

E. J. Miner, assistant city engineer of Cincinnati, has resigned to accept a position in the Buffalo office of the International Joint Commission. Mr. Miner has been engaged in engineering work since 1907, and has had much to do with sewer design and construction during that period.

Charles R. Gow, who was recently elected president of the Boston Society of Civil Engineers, is a graduate of Tufts College, and has been engaged in engineering practice and construction work since 1893. Among other works he constructed in the capacity of contractor is the filtration plant in the city of Springfield, Mass.

Ernest M. Merrill, civil and mining engineer, of Beckley, W. Va., has been appointed to open a branch office in Mullens, W. Va. J. P. Irwin is resident engineer in charge of this office, the purpose of which is to handle engineer work for the many new coal-mining operations that are developing in the vicinity of Mullens.

Col. Henry Jervey, Corps of Engineers, U. S. A., has been assigned the general supervision of the Government river improvement service from Pittsburgh to the southern terminus of the Ohio Division. This includes the supervision of the district covering the Muskingum, West Virginia and Kentucky Rivers, which has lately been in charge of General Sibert.

William L. Saunders, president of the Ingersoll-Rand Company, of New York City, has been appointed a member of the Federal Trade Committee, which will act in co-operation with the new Federal Trade Commission of the Chamber of Commerce of the United States. Earlier in the year, as announced in these columns Feb. 27, Mr. Saunders was elected president of the American Institute of Mining Engineers.

Frank C. Tolles, assistant engineer for the sewerage division, Public Service Department, Cincinnati, has been granted a year's leave of absence to accept an appointment as district engineer in the Buffalo office of the International Joint Commission engaged in making studies toward the elimination of the pollution of the Great Lakes. Mr. Tolles was graduated from Cornell University in 1905, and since then has been engaged in various branches of the civil engineering profession, but principally in connection with the design and construction of sewers.

L. F. Lonnbladh, formerly engineer maintenance of way of the Missouri, Kansas & Texas Railway, has been appointed chief engineer, with headquarters at Dallas, Texas. Mr. Lonnbladh was born in Boras, Sweden, and was graduated from the Boras Technical College in 1898. For a few years he was engaged in railroad work in Europe, coming to this country in 1902 as office engineer for the Tennessee Construction Company. He entered railway service in this country as an assistant engineer for the Tennessee Central Railroad and attained the grade of superintendent on it in 1905.

Edward Wegmann and A. G. Hillberg have become associated as consulting engineers, specializing in hydraulic work. Mr. Wegmann was for many years connected with the construction of the Croton waterworks for the city of New York and was the last chief engineer for the Aqueduct Commissioners of the same city. Later he was appointed consulting engineer of the Department of Water Supply, Gas and Electricity of the city of New York. Mr. Hillberg has, for the past two years, been an associate editor on the staff of the Engineering Record, and had previously been connected with several large hydroelectric developments.

C. R. Rockwood, chief engineer of the Imperial Irrigation District, has been selected as superintendent of the Volcano Lake works in connection with the flood-prevention construction that has been started in the Imperial Valley, as noted in this journal March 13. Mr. Rockwood has been engaged in engineering work since 1881. For nine years he was on railroad location and construction. He was then for a short period deputy city engineer of San Francisco, leaving this post to enter the service of the U. S. Geological Survey on irrigation work.

T. McLean Jasper, a sanitary engineer of Chicago, sailed March 26 for England to join Kitchener's army. He was graduated from the University of Illinois in 1911. With Alvord & Burdick, consulting engineers, Chicago, he assisted in making waterworks valuations, hydroelectric tests, and in preparing Mr. Alvord's expert evidence on the New York sewage pollution case. In 1913 he was assistant examiner of efficiency in the bureau of efficiency, Civil Service Commission. His most arduous task was the development of plans and construction of the temporary garbage plant in the Chicago Health Department. Recently he has been doing efficiency work in the Board of Health.

Obituary Notes

F. H. Hambleton died in Baltimore March 19. He was for many years chief engineer of the Consolidated Gas, Electric Light & Power Company, of Baltimore.

Walter A. McFarland, formerly superintendent of the Water Department of Washington, D. C., died in that city March 17. His first engagement along engineering lines was as assistant engineer on river and harbor work in New York City in 1888. The principal work of his lifetime was the rearrangement of the entire water distribution system of Washington soon after he entered the service of the water department in 1896. Since that time he has had charge of the design, construction and maintenance of all later additions to the system.

Charles Francis Adams, publicist, and authority on railroad administration, died March 20, in his eightieth year, at his winter home in Washington, D. C. Mr. Adams was a pioneer in railroad regulation, being a member of the Massachusetts Board of Railroad Commissioners from 1869 to 1879. From 1877 to 1890 he was Government director of the Union Pacific Railroad, and during the last six years of that period was president of the road. He was recognized as a deep thinker, and wrote on a variety of topics. Among his discussions of railroad matters are "Chapters on Erie, and Other Essays" and "Railroads, Their Origin and Problems." Last fall he addressed an open letter to President Wilson deploring the present trend of railway regulation and pointing out the urgent necessity of increased freight rates to save the railroads from disaster.

Civil Service Examinations

Examinations Previously Announced

Date		See Eng. Record
April 28–29	Surveyor - draftsman, U. S. Government service, salary $1200-$1500	Mar. 20
April 3	Junior assistant in the engineering department, New York State	Mar. 13
April 14	Civil engineer and draftsman; copyist draftsman, Navy Department; mechanical draftsman, Panama Canal Service; ship draftsman, Navy Department; topographic draftsman, Panama Canal Service; engineer, Indian Service; United States	Feb. 6